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*Vol. 72, No. 26* New York, December 28, 1918 *Pages* 1209--1256

# Electrical World

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Member Audit Bureau of Circulations, Member Associated Business Papers, Inc.

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Publishers also of
Electrical Merchandising
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Chemical and Metallurgical Engineering
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No back volumes for more than one year and no back copies for more than three months.

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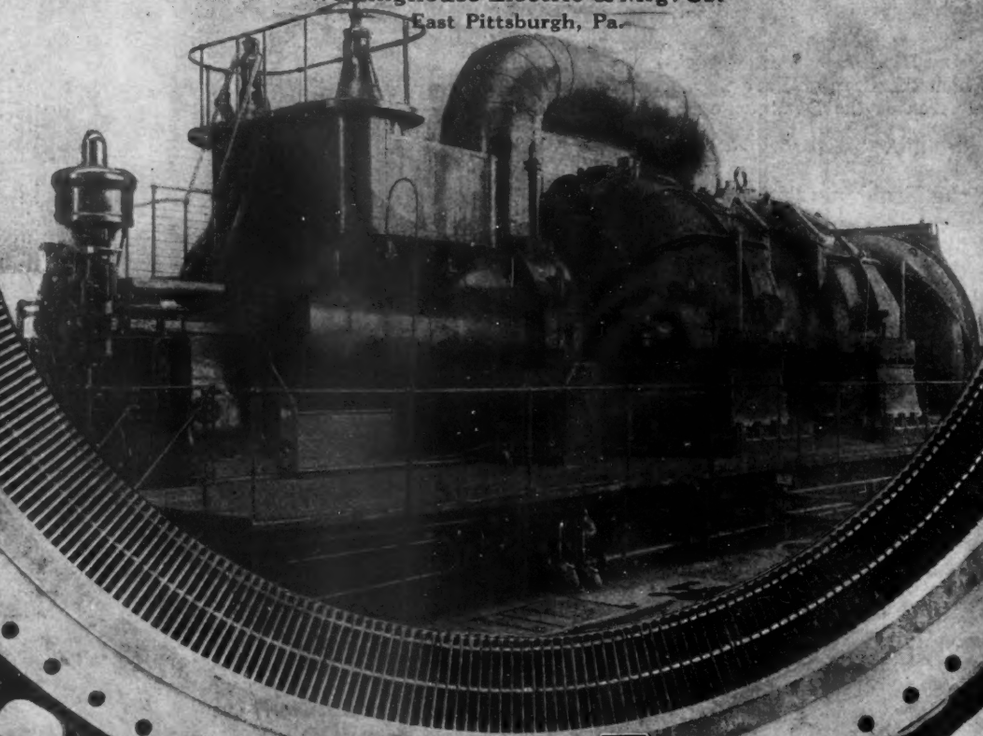

# Westinghouse

# Electrical World

*The consolidation of* ELECTRICAL WORLD, ELECTRICAL ENGINEER *and* AMERICAN ELECTRICIAN

*Volume* 72 New York, Saturday, December 28, 1918 *Number* 26

## America's Opportunity and the Engineer

IN NO spirit of vainglory or of greed, but with full realization of the solemn responsibility that the fact implies, and with recognition that international coöperation rather than international antagonism should be the future's watchword, every thoughtful American must perceive that as peace once more becomes established the United States will loom potentially if not actually the leading commercial nation of the world. The great engine of German foreign trade, reared with so much skill and care, lies crushed beneath the ruins of the medieval structure that housed it and the armed barbarism by which its expansion was sought. Austria is no longer even a geographical expression but only a political reminiscence. Russia, the home of chaos and the sport of anarchy, is hopelessly out of the running. Italy has not the capital or the widespread commercial spirit. France, more than ever the home of the fine arts and the nurse of valor, the "second country of every man," has been too sorely stricken by the long years of war to assume at once the commanding position in the world of trade that, were she able to take it, no generous soul would grudge her. Japan, secure in her Asiatic primacy, is unlikely for years to come to bid actively for more distant business. There remains of all the Great Powers only Great Britain to contend with the United States in fair and friendly rivalry for first place. Still to rank below that great trading nation would be no disgrace, and enemy mischief makers will fail if they try to sow the seeds of national ill will in business channels; but, with our continental solidarity as against Great Britain's scattered empire, with our triumphant melting pot as against her millions of unassimilated population in India and with our new merchant marine compelling enterprise by the fact of its existence, the elements in the case favor America.

The engineers of the nation have an interest in trade expansion that is both direct and indirect—direct because they stand back of the machinery and the sources of light, power, traction and communication that form so important a part of export business; indirect because trade means production and production means prosperity, and with the growth of prosperity opportunities for engineering ability multiply both at home and in the countries with which commercial relations grow closer. All the great national issues that bear on trade have therefore a special professional interest for engineers as well as the patriotic interest which engineers share with other good citizens. Shall the United States become a partner in a league of nations or perpetuate its hemispheric isolation? Shall the trend of tariff legislation be toward free-trade ideals or toward scientific protection? What means shall be tried to promote a lasting peace between capital and labor? Shall old-fashioned American individualism prevail or socialistic tendencies be met half way? Are private monopolies to go? Shall national, state or municipal government be extended to include the ownership or control of public utilities? These are perhaps the most insistent political questions with a direct commercial bearing. On them engineers individually, and where possible collectively, should be heard.

*Vision, not hesitation, will land us the quicker upon the shore of peaceful development. A little more of the spirit of Columbus and a little less of the practice of Lot's wife is needed. Who can doubt the reward behind the curtain of 1919 for the progressive worker in electricity?*

## Water Power as a National Asset

CANADA can teach us much regarding the conservation of natural resources. Her water-power sites are not only surveyed; their economic features, capacities and in many instances costs of development are known as well. Moreover, in seeking to have these resources used, the Dominion government, while it affords reasonable protection to the public, at the same time offers suitable financial reward to private enterprises. There is, however, little advantage for Canada to develop power which is transmitted to the United States, especially when there is a shortage of power in the Dominion. Many Canadians are, therefore, solicitous about her natural resources and insist that her water powers should be developed for her people. Hence the growth of immense systems like that of the Hydro-Electric Power Commission of Ontario. Inasmuch as the greater part of the population of the Dominion of Canada dwells along the St. Lawrence River valley and it is in the provinces of Quebec and Ontario that the greatest amounts of power are developed and used, the utilization of the waters of the St. Lawrence for power purposes is of immense interest to Canadians. There are no indications that the Canadians object to the joint development of the river by the Dominion and the United States or by the two provinces mentioned and the State of New York. But Canadians have a very firm conviction that none of the water should be used for private enterprises. The water may be used by local, state and national governments or by creatures of those governments in the shape of public utility corporations amenable to rules and regulations of the respective states as to rates, service, etc., through commissions. A similar public opinion regarding water powers is beginning to crystallize in this country.

## The Foreign Trade Door Open

AS A NATION we have much to learn on the subject of foreign trade, and it is high time that we made a substantial beginning. The countries of the world will want to exchange products with us. There will be a redistribution of some of the channels of trade. Our unsurpassed record for big-scale production, our stores of raw materials, aptitude in learning, the financial strength of industries and the nation as a whole, fit us to interchange products so as to promote friendly trade relations on a degree never before possible to our people. Our position as a creditor nation makes it highly desirable that new thought and study shall be given to the requirements of foreign consumers and especially to methods of financing with which they are accustomed. The seller and buyer will have to talk in terms that both understand. Some people have yet to be taught that the United States manufacturer will have to make the goods and terms of payment that the foreign buyer wants. It will take patience to do this by system, and patience is not the pet virtue of the idolized type of our trigger business man looking for quick results. But whatever the terms, whatever the length of time needed, it is imperative that the industry set about it to prepare to take a large part in the future international commerce and financing of the world. Our foreign trade knowledge now rests largely with the companies which have done an international business for many years, notwithstanding unsympathetic laws and lawmakers, and they have paid a price for their information. Certainly the big companies have done much in the past to build a reputation for this country in foreign lands. They have put distributive organizations in the leading countries where sales are possible; they have established connections, men and agents trained in their products and the needs of consumers; their names and output are known favorably. They have faced European competition for years; they are able to market apparatus and supplies where that competition exists. Probably they can continue in much the same way as they have done. But with expanding circles of consumers in other countries it is to be hoped that they will develop the size of their business in proportion. They are entitled to benefit from their pioneer work.

With the small companies in the electrical industry the desirability of building export business under the new domestic and world conditions is also clear. They have a large productive capacity; they can meet competition as the large companies meet it; they have their individual problems of keeping labor employed at good wages. Under the old conditions they lacked sufficient points of contact with buyers in foreign countries to make a profitable business easy, if indeed it was practicable at all. They could not afford to finance exploitation of foreign possibilities as readily as companies of greater resources. But now that Congress has opened the way for coöperative organizations in foreign trade through the enactment of the Webb law they can initiate a movement to represent a number of units in the electrical industry. Readers of the ELECTRICAL WORLD who study foreign trade possibilities are undoubtedly familiar with the combinations formed under this law by the copper and steel producers. The Copper Export Association, Inc., now includes the largest copper producers, but is designed to include any smaller producers. The North American Steel Products Corporation now embraces ten producers, but is expected to represent eventually all important steel-producing companies of the country except the United States Steel Corporation, which, of course, has its own extensive foreign marketing organization. In just what form, if any, electrical manufacturers will decide to coöperate probably the future will reveal, but the opportunity is open.

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*Life cannot go stale as "the tumult and the shouting die" if the open mind remains. The progress of applied science has been enormously accelerated by the war, and now is the time to go forward from a new base. The best brains are wanted to grapple with the problems and opportunities of the new era, but the issues are so far-reaching that the most humble constructive thought may be helpful.*

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## The New Multiplex Telephone System

THE Postmaster-General has recently issued a public statement through the daily press, on information supplied by the president of the American Telephone & Telegraph Company, concerning the practical introduction of a new multiplex telephone and telegraph system on loop-line conductors.

The statement is gratifying not only to electrical workers but also to the members of the general public. The achievement constitutes a new step in the transmission of thought, in the communication of ideas, in the permeation of the material world by the intellectual world. The mere fact that such a step has been already taken in the actual practice between Baltimore and Pittsburgh for a number of months is a real benefit to the dwellers in those cities; but it is also a potential benefit to the dwellers in the most remote and uncultivated regions of the globe. The fact is notable, the accomplishment memorable, and all the contributors are, in the various degrees of their contribution, worthy of corresponding renown.

There is, however, another aspect of the matter which deserves to be considered. The new result which has been achieved is more than a mere utilitarian public benefit. It is also an engineering achievement developed not solely by the expenditure of money but, in addition, by the exercise of inventive skill and scientific ability. It is incumbent upon the company, which has announced the result in general terms to the general public, to make a corresponding announcement in technical terms to the engineering world. This does not necessarily entail the abandonment to the public of any of the rights of the company as possessor of a new telephonic process. It merely involves the rendering unto Cæsar of the things which are Cæsar's. Because the scientific world has trained and equipped, with the knowledge of past eras, those men who have been able, under the company's skilled leadership, to bring about an important new result, it is reciprocally due to the scientific world that the means for and the process of attaining the result should be made known.

We may, then, properly expect that a clear and adequate technical description of the new multiplex system

will be communicated by the company to the engineering public at an early date, through the medium either of the electrotechnical press or of the electrical engineering societies' proceedings, or through both these channels.

This acknowledgment of indebtedness to the great fountainhead of scientific knowledge, fundamental or applied, is the more important at this time because as a nation we seem to be tending to intrust our large enterprises of all kinds to the tender mercies of an all too socialistically ambitious government. The theory implied in the suggestion that the government should either do everything or as near to everything as it can is that the average citizen, elected by popular vote, can do any duty well to which he may be honestly assigned. This seems to be a fundamental democratic doctrine. In opposition to this belief, engineers well know that only a relatively few men, specially selected for their native ability and for their technical training, are properly competent to undertake engineering responsibilities for the public service. The appointment of honest and well-meaning but inexperienced and untrained public servants to positions of specialized duties is wasteful in the extreme. This fact is not nearly so generally known as its importance deserves, and it behooves the scientific, the technical and engineering sections of the community to bring it clearly before the world at large.

Any policy on the part of the large engineering and public service corporations to conceal the scientific, technical and engineering work which they achieve with great effort and pain tends to play into the hands of those who think that all things can be done more or less equally well by the average man, and who therefore honestly believe that since the government is carried on by an average group of men, elected by the average man, the said government is the proper body to administer all public and engineering needs. On the contrary, the large public service corporations, being fully aware of the great importance of the service of specially trained specialists, should do all that can be reasonably expected of them to acknowledge the aid of specialists and to foster the supply of every needed type of specialists in the community.

*War and repression go hand in hand. Civil needs are curtailed in great international emergencies, and major energies are concentrated for attack and defense. Victory unlocks old doors of opportunity as well as new ones. Let the electrical industry enter into its greater heritage with confidence and high resolve that splendid service may follow the patriotic achievements of the epoch just ended.*

## The Fuel Administration

DR. GARFIELD'S work as Fuel Administrator was a conspicuous part of the mobilization of industry for war efficiency. It was evolved in conditions which will probably never again be in existence in this country. It came into operation at a moment when prices for coal were in an extraordinary state of jumble. With the country in a war fever, there were inconsistencies in prices, there were inequalities in distribution, there were mistakes of direction. In this somewhat confusing mixture of events a clear and definite policy of conservation was developing. And conservation, as it finally developed in the Fuel Administration policy, was economy of fuel and economy of the power and heat resources of the nation. This meant, if extended to its logical conclusion, the survival of the fittest. It could mean nothing else than the enlargement of the field of usefulness of the central station, the upbuilding of the central-station industry. What the Fuel Administration wanted, what it had to have, was precisely the kind of service that the central station gave. The Fuel Administration was not tardy in recognizing the value of the central station to the community at a juncture when the life of the nation was at stake; but its early recognition was strengthened by new conviction as time brought out the real facts. "Lightless" nights and "workless" days, we can now see, are insignificant things compared with the indorsement of the central-station principle.

*Customer ownership multiplies points of contact between public utilities and the people whom they serve. From the entente cordiale thus derived spring better understanding and direction of company policies and a closer personal touch between server and served. Let us capitalize the thrift taught by our Liberty loans for the mutual benefit of the electric service companies and their communities, thus securing the benefits of a large measure of popular ownership without the drawbacks of political administration.*

## Reorganizing a Small Central Station

THE description by Leo Lustig of the rehabilitation of a little Cuban plant is another example of the importance of getting at the root of matters instead of continuing the policy of patching up. The case which he describes is absolutely typical of hundreds not yet taken effectively in hand. Here was a little city of about 16,000 inhabitants with a three-phase, 2300-volt distribution and single-phase secondaries. The plant had grown up gradually until the phases were badly out of balance, transformers and feeders overloaded, and things steadily going from bad to worse as load increased. Finally the worm turned, and the course of improvement described by Mr. Lustig began. A plan of the distribution system was made, the network was redesigned, transformers were placed as near their centers of load as possible, and the phases balanced. In numerous instances 10 to 20 volts increase of voltage was obtained simply by reconnecting the load to the transformers. In redesigning the distribution plans were made for no more than 2 to 3 per cent drop in the secondaries even on a 5 per cent increase of load. All transformers below 3 kw. were thrown out, the secondary distribution was passed over to a three-wire system, and the motor service was rearranged. The poles were relocated, transformers more conveniently placed on the poles, all connections soldered and the house connections standardized. The result was that losses were minimized, better capacity was obtained for the equipment and the service so improved that added consumption promptly resulted.

Mr. Lustig notes that similar and even worse conditions than those originally here existing can be found on many other systems in Cuba. For "Cuba" read "the United States," and one will not be far from the truth.

# Reliability of Large Turbines*

## Answers to Questions Frequently Raised Regarding Advisability of Using Larger Units, Reliability and Problems of Design—Limits of Commercial Practicability of Large Units Are Not Yet Reached

BY J. F. JOHNSON
Engineer Turbine Department, Westinghouse Electric & Manufacturing Company

THE remarkable growth of the electric power industry during recent years has been paralleled by an equally remarkable growth of steam-turbine-driven generating units. So rapid has this development been that frequently before the first machine of a new design was completed another of materially greater capacity and higher efficiency was being designed. For example, machines of 15,000 kw. rating were put into operation as early as 1908, but their use did not become general until 1913; whereas to-day nearly every one of what may be called our large generating stations has at least one unit of 30,000 kw. capacity or larger in service or on order.

The question arises, has this growth been natural, logical and healthy, or has it suffered temporarily from over-stimulation which is destined to result in a relapse or reversion to smaller sizes? If such reversion occurs, will it be the result of faulty engineering, born of overconfidence on the part of the builders of the apparatus or on the part of the users; that is, will it be because units of necessary reliability and economy are not commercially obtainable or because units of 30,000 kw. and larger are too large for the present and immediate future requirements of our large power-generating stations? While these questions will probably remain unanswered to the satisfaction of all for some time, it is with the hope of throwing some light on the subject that this article is presented.

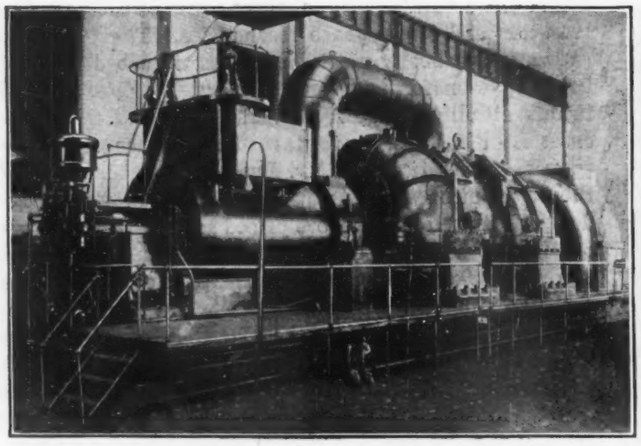
It is believed that a careful analysis of the present multitude of applications of electric power will not disclose in a single important one any serious element of fad or any likelihood of its use in that application decreasing. On the other hand, there are many applications in which marked future growth seems certain. There can be no doubt that the electric power industry is to-day only in the midst of a rapid, healthy growth, as shown by the following table:

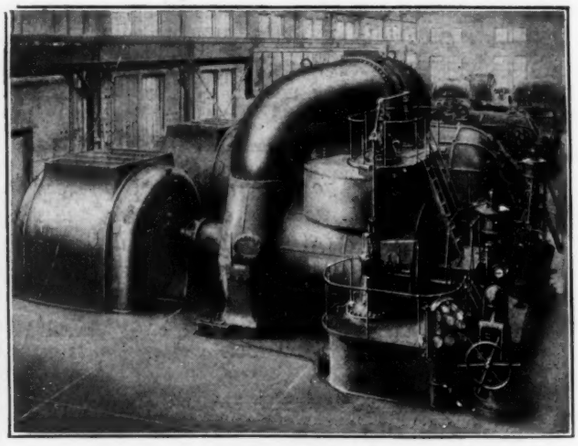
| District | Sum of Maximum Sustained Peak Load All Companies in 10-Mile Radius 1917 | Total Capacities† to Be Installed by 1920 |
|---|---|---|
| New York | 800,000 | 1,190,000 |
| Chicago | 400,000 | 596,000 |
| Philadelphia | 250,000 | 373,000 |
| Buffalo and Niagara Falls | 300,000 | 447,000 |
| Detroit | 155,000 | 231,000 |
| Boston | 155,000 | 231,000 |

†Based upon an estimated increase of peak load of 8 per cent each year and a surplus of generating capacity installed above peak load of 20 per cent.

The choice of sizes of generating units is important because the number and sizes of units will materially affect the total cost of power generated. If the units be too small and the number too large, the cost per kilowatt of the station completed will be greater, the maintenance and operating expenses higher, the efficiency poorer and reliability at least no greater than if the proper sizes are used. On the other hand, if the units be too large, the cost per kilowatt installed may be too large because of the greater reserve or stand-by capacity required, and the efficiency may even be poorer by reason of the units operating at loads too far below their points of best efficiency.

Take, for example, a district with a maximum peak requirement of 600,000 kw., which to insure proper reliability it is decided to generate in three stations of approximately equal sizes. We will assume that these stations will normally always operate in parallel with each other and that there will be one spare unit for





FIGS. 1 AND 2—TANDEM-COMPOUND REACTION TURBINE OF CHICAGO COMPANY CONNECTED TO SINGLE 30,000-KW. GENERATOR; CROSS-COMPOUND TURBINE SET RATED AT 40,000 KW. BELONGING TO PITTSBURGH COMPANY

*Features of address before A. S. M. E. meeting at Pittsburgh.

each five in service during the peak. If 20,000-kw. units are used, there will be thirty operating and six spares, making a total of thirty-six units, twelve in each station. If 30,000-kw. units are used, there will be a total of twenty operating and four spares, making a total of twenty-four units, eight in each station, etc.

If, for the sake of simplification, it is assumed that, irrespective of the size, the reliability, efficiency and

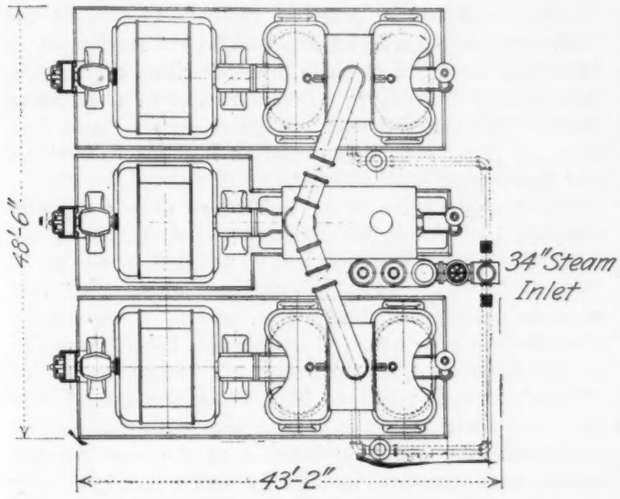



FIG. 3—THREE-CYLINDER CROSS-COMPOUND TURBINE WITH ONE HIGH-PRESSURE AND TWO LOW-PRESSURE CYLINDERS RATED AT 70,000 KW. USED BY NEW YORK COMPANY

purchase price per kilowatt will be the same, it should be obvious without resorting to calculations that the 20,000-kw. size is too small and that best results are to be expected with either the 40,000-kw. or the 60,000-kw. size, because the installation costs, including buildings, foundations, piping and switching equipment, and operating costs, including maintenance supplies and attendance, should be less per kilowatt. The efficiency would be higher because of the higher efficiency of the larger units, larger auxiliaries and smaller friction and radiation losses in the larger steam and water piping, and the reliability would be greater because of the smaller number of operations of starting and stopping and cutting in and out of service of units necessary.

In so far as conditions affected by the design of units are concerned, it is quite generally appreciated that in sizes up to at least 30,000 kw. rating, higher efficiency at the same cost per killowatt is obtainable purely by reason of the larger size and still higher efficiency for a slight increase in cost per kilowatt, and it has been quite conclusively demonstrated that as high a degree of reliability is obtainable in the larger units as in the smaller ones.

While districts in which the peak requirements of any one operating company are as great as from 400,000 kw. to 600,000 kw. are at the present time not numerous, there are many which will probably reach that stage before installations being made at this time will be expected to become obsolete. In these units of the larger sizes should be introduced to replace smaller ones as they become obsolete and to take care of increasing requirements at such a rate as will affect the most economical production of power over the estimated period of usefulness of the machines installed. Numerous generating stations of around 200,000 kw. installed capacity, projected and designed by the ablest engineering talent in the country, are under construction and in operation, and units of 30,000 kw. and larger are being employed in them. Stations of approximately 300,000 kw. installed capacity are being projected and probably will be built in the near future.

To show that large units are commercially practicable within limits not yet reached, that increase in size need not impair reliability and may improve efficiency, and to point out that any difficulties experienced with them can be corrected after proper analysis of the trouble, the writer will refer to installations of large-size units furnished by the company with which he is connected. Up to the present time this company has furnished fourteen large-size units, ranging in capacity from 30,000 kw. to 70,000 kw. Of these eleven have been shipped, ten are in service, and seven have been in service for one to five years. Their performance should speak for itself.

### EXPERIENCE WITH NINE LARGE UNITS

The first three of these units‡, which are exact duplicates of each other, were sold to the Interborough Rapid Transit Company of New York. They are of the two-cylinder, cross-compound, pure-reaction type, rated at 30,000 kw. (maximum) with the highest efficiency

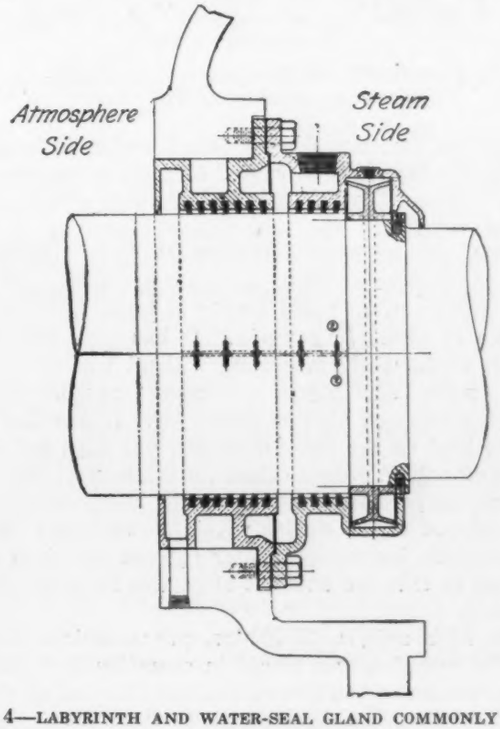



FIG. 4—LABYRINTH AND WATER-SEAL GLAND COMMONLY USED

at 25,000 kw., the high-pressure units operating at 1500 r.p.m. and the low-pressure at 750 r.p.m.

These units since their installation (December, 1914, February and August, 1915, respectively) have been operating on an average from sixteen to twenty hours per day, on fluctuating railway loads varying from 10,000 kw. to 30,000 kw. With the first and third no

‡See paper by H. G. Stott and W. S. Finlay, presented at May, 1916, meeting of New York Section of the A. S. M. E., for results of tests.

troubles of any sort have been experienced, and they have been ready at all times for any service within their designed capacity except when out of service for regular periodic inspection or ordinary maintenance. On the second the labyrinth packing on the balance pistons of the high-pressure element has failed three times, requiring renewal of some parts. The cause of these failures was at first supposed to have been improper adjustment, but investigations following the third failure indicated excessive lost motion in the thrust bearing and heavy distortional stresses caused by rigid bracing of the steam pipe near the turbine as the probable causes.

The fourth unit, placed in operation in the Northwest station of the Commonwealth Edison Company, Chicago, in September, 1917, consists of a tandem-compound, pure-reaction turbine direct-connected to a single generator. It has a rating of 30,000 kw. with an additional overload capacity of 5000 kw. operating at 1200 r.p.m. A few hours after being put into service, subsequent to completion of erection, the labyrinth packing

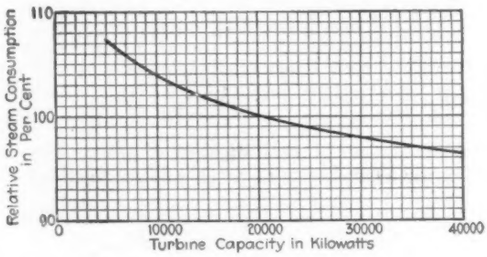



FIG. 5—APPROXIMATE WATER RATES OF DIFFERENT-SIZE TURBINES AT MOST EFFICIENT LOADS

on the low-pressure element failed, owing to buckling of the turbine cylinder, caused by rigid piping connections between the two surface condensers, which are bolted rigidly to the two exhaust openings on the turbine, preventing the condensers from translating with the turbine as its temperature increased. Temporary repairs were made locally and the unit put in service in about four weeks. It has been operating almost continuously ever since without trouble of any sort (except cracking of a copper expansion joint), carrying loads as high as 40,000 kw. In one instance it was kept on the line for seventy-one days and then taken off only in order to clean the condenser. Material for making permanent repairs to the labyrinth packing was shipped to the station within a few months after the accident, but the purchaser has not yet given permission to take the unit out of service long enough to install it.

The fifth unit, a 30,000-kw. pure-reaction, single-cylinder machine, was placed in operation in the Gold Street station of the Edison Electric Iluminating Company of Brooklyn in October, 1917. With the exception of a few leaks in the oiling system and the breaking of a defective gear on the oil-pump drive, no trouble of any sort has been experienced. It has been available for service at all times, and has been operating almost continuously, except over Sundays and when necessary to clean the condensers, at average loads of approximately 23,000 kw. and peak loads running as high as 32,000 kw.

The sixth unit, placed in service in December, 1917, in the Kent Avenue station of the Brooklyn Rapid Transit Company, is a duplicate of the fifth machine. Just after installation some rebalancing of both turbine and generator rotors was necessary. After having been in service approximately ten months the thrust bearing overheated and wiped to some extent, but did not damage any other part of the machine. When opened for inspection it was found that the labyrinth packing strips, which were made of an aluminum alloy, were considerably corroded by the action of strong alkalis used at this plant for treating feed water; and two rows of blading in the high-pressure portion of the machine were found to have been damaged at some previous time, this having been caused probably by foreign matter or a defective blade. This machine was in regular service up to that time, carrying maximum loads as high as 31,000 kw. and an average of 25,000 kw.

The seventh unit is a 40,000-kw. cross-compound machine, installed in the Brunots Island station of the Duquesne Light Company, and was placed in service in December, 1917. The high-pressure element of this machine operates at 1800 r.p.m. and the low-pressure element at 1200 r.p.m. This unit has been in regular service carrying loads normally of from 30,000 kw. to 40,000 kw. with peaks as high as 50,000 kw. While operating the machine to correct the balance of one of the generators, the main bearing at the coupling end of the high-pressure turbine burned out, apparently owing to interruption of oil service to that bearing. This let the spindle down sufficiently to cause rather heavy blade rubs throughout the machine. The bearing was rebabbitted and the machine put back in service without any other work being done except rechecking the clearances and placing a balance weight on the spindle to correct for the weight which had been rubbed off the blades.

Later the generator was damaged by electrical trouble, and while this repair was being made both elements of the turbine were dismantled. The high-pressure rotor was returned to the shops, the damaged blading replaced and rebalanced. New blading was also installed in the stator to restore original clearances and original efficiencies. Inspection of the low-pressure element revealed several broken blades which were defective and had slightly damaged the rest of the blading in those rows, requiring replacement of approximately one and one-half rows of blading on each end of the machine.

The eighth unit, practically a duplicate of the seventh, rated at 45,000 kw. (maximum), was delivered to the Narragansett Electric Light Company in Providence in January, 1918. In placing this machine in service the labyrinth packing on the high pressure was damaged, owing to improper adjustment, which necessitated temporary repairs. Since making them no trouble has been experienced except some distortion of the couplings caused by a series of violent short circuits and some defective workmanship on the fitting of the coupling keys. Permanent repairs to the labyrinth packing have been made and new coupling parts are to be installed in the near future. In the meantime the old parts are operating satisfactorily without any evidence of distress. This machine operates on loads as low as 5000 kw. and has carried a peak load of 50,000 kw. for periods of from four to five minutes.

The ninth unit is a 70,000-kw., three-cylinder, cross-

compound machine installed for the Interborough Rapid Transit Company in New York. One low-pressure element was placed in service April, 1918, operating on high-pressure steam. The one high-pressure element was placed in service in August, operating in connection with the low-pressure element already installed, and the second low-pressure element was placed in service in October. Some intermittent vibration trouble appeared on the first low-pressure machine, the cause for which was found to be lack of sufficient clearance on one of the spindle rings, causing distortion during expansion. After this was corrected no further trouble was experienced except the breaking of a few defective blades on the intermediate stage of the second low-pressure element.

This unit is equipped with an automatic-control mechanism for cutting out of service, either automatically or manually, either element without disturbing the other two. These features have been given a thorough tryout, which in so far as a demonstration goes has verified all expectations as to flexibility of operation of a multiple-unit set. In regular service it has carried loads as high as 55,000 kw. with swings up to 61,000 kw.

While these records do not all show 100 per cent perfection, they do show that in not one instance has there been any evidence of inherent or basic defects in design or difficulties in construction or operation. Some troubles have been experienced, but these have all been of minor character, due to avoidable defects in detail design, construction, installation or operation, such as are experienced with new designs of any size or sort. It is significant that with one exception no important part of any one of these units has ever been returned to the works for replacement, alteration or repair. The high-pressure rotor of the Duquesne Light Company unit was returned to the shops for checking for truth and reblading. While most of them have not been subjected to any accurate steam consumption tests, definite reductions in station coal consumption rates were effected by their installation.

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## A 110,000-VOLT LINE OVER THE ST. LAWRENCE RIVER

### Even Though Expense Is Greater, Span of 4800 Ft. Was Preferred to Submarine Cable Transmission—Details of Construction

Engineering problems involved in the construction of one of the longest transmission-line spans in the world were outlined in a paper read before the recent Toronto convention of the American Institute of Electrical Engineers by S. Sevenningson.

For a number of years the Shawinigan Water & Power Company has been transmitting energy from the generating plants at Shawinigan Falls north of the St. Lawrence River to towns south of the St. Lawrence River. The voltage has been stepped down from 50,000 volts on the transmission line to 25,000 volts, for transmission under the river by submarine cables, and up again to 50,000 volts for the lines on the south side. On account of the demand for energy on the south shore, however, it became necessary in 1916 to increase very greatly the capacity of the system for this growth in load. Submarine cables have always been a weak point in this part of the system, the current in the river sometimes carrying them down stream and even pulling them apart. It has even been necessary in the winter time to erect temporary wooden-pole lines across the ice to maintain service on the south shore. The company then decided to make an overhead crossing instead of putting in additional submarine cables, even at a cost of $200,000 compared to a cost of $150,000 for submarine cables.

#### DESIGN OF 4800-FT. SPAN

A single span of 4800 ft. (1460 m.) was finally decided upon in preference to a round-about route by which it would have been possible to cross the river in three spans. There are two towers 350 ft. (106 m.) high and 60 ft. (18 m.) square at the base, the upstream and downstream faces tapering to a width of 14 ft. (4.3 m.) at the top. Piers for the foundation were constructed in the form of hollow cylinders of reinforced concrete with an outside diameter of 11 ft. (3.3 m.) and an inside diameter of 7 ft. (2.1 m.) on account of the great depth of sandy soil. Galvanized plow-steel cables 1⅜ in. (3.5 cm.) in diameter span the river on 50-ft. (15-m.) centers. These cables on test showed a yield point of 193,000 lb. per sq.in. (13,600 kg. per sq.cm.) and an ultimate strength of 227,000 lb. per sq.in. (16,000 kg. per sq.cm.). Although the cables will be the ultimate transmission conductors, they are at present messengers for supporting No. 1/0 copper conductors. This temporary construction was necessary on account of the inability of the company to obtain satisfactory insulators for the steel cables at that time.

The insulators which it is proposed to use when the steel cable becomes the transmission conductor are of unusual design, putting the insulators in compression instead of tension. These were described on page 1041 of the Nov. 30 issue of the ELECTRICAL WORLD. Excepting that the copper conductors were torn loose from the messenger cable by unusual mechanical resonance on one occasion, little difficulty has been experienced with the overhead span thus far, although a severe winter has not yet been weathered. On account of an increase in sag of from 24 ft. to 27 ft. (7.3 m. to 8.2 m.) in the first few months of operation, it was found necessary to draw up the cables after this time. The stretching of the cables was attributed to the movement of the strands on the central core.

#### SERIOUS ICE CONDITIONS

On account of ice conditions which occur in the river, some kind of guard piers outside of the towers were deemed necessary for their protection. Some 3000 tons of field stone were deposited on the river bed on each side, about 75 ft. (22 m.) from the upstream and river faces of the towers, carrying the rock to an elevation about 3 ft. (90 cm.) above the water level. Ice conditions last year were exceptionally severe, however, and the ice passed over the tops of these breakers and piled up around the tower foundations to a height of 25 ft. or 30 ft. (7.6 m. or 9.1 m.). No damage was done, but the company is at present completing new guard piers by means of reinforced-concrete cribs filled with rock and carried to a level of the maximum recorded high water.

# Canada's Heritage in the St. Lawrence River*

## The Estimated Low-Water Power Aggregates 2,000,000 Hp., of Which the Greater Part Is Wholly Within the Territorial Area of the Dominion and Capable of Development

BY ARTHUR V. WHITE
Consulting Engineer Commission of Conservation, Ottawa, Ont.

THE St. Lawrence as the wonderful water highway from the Great Lakes to the sea has been improved chiefly by the canal systems of the government of Canada. The new Welland Canal is being constructed with locks of 30-ft. (9-m.) draft. If it is to be used so that deep-draft, ocean-going vessels may go up to the head of navigation of the Great Lakes, then the St. Lawrence River in portions of its main channel will have to be canalized by means of a series of dams with suitable locks. If the river as a whole be canalized, obviously the water power of the river would be most economically developed by having the dams necessary for the navigation improvement made adaptable also for the development of water power.

One fact is certain, and that is that, in order to conserve the integrity of the St. Lawrence River so that it may suitably be canalized—when the time comes for such work—its integrity must not be compromised by permitting the erection of structures in the main stream for piecemeal development of power, although this has already been done to some extent. Naturally, there is a great temptation for water-power companies to do on the St. Lawrence as has been done elsewhere, namely, to make the cheapest possible preliminary developments—skim the cream off the powers, so to speak—for by so doing interests may readily acquire markets and vested rights, and often control of the general situation.

Canada's heritage in the navigability of the St. Lawrence, in a word, may be summed up that deep-draft navigation from the Great Lakes to the sea involves, absolutely, the treatment and canalization of the St. Lawrence River as a unit.

### WATER POWERS OF ST. LAWRENCE RIVER

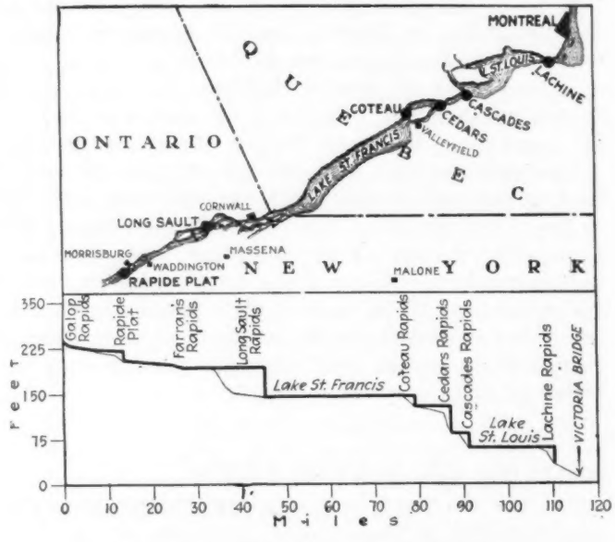
The water powers of the St. Lawrence River are as yet largely within the control of the people. The recent shortage of hydroelectric power which has been so keenly felt both in Canada and the United States has drawn increased attention to the enormously advantageous powers in and adjacent to international boundary waters. Most of the water powers which are more readily capable of economic development in Canada as well as in the United States either have already been developed or are privately controlled. Concentration of ownership is a noticeable feature of this control. Canada cannot afford to have her St. Lawrence River powers pass into the hands of powerful private interests.

With respect to development of these water powers, there are some very important points such as ice conditions, the exportation of Canada's share of electrical energy and the character of the agencies utilizing the power.

*From address delivered before the Electric Club of Toronto, Nov. 22, 1918.

Power development on the St. Lawrence River cannot properly be considered apart from the subject of the ice menace. Too great caution cannot be exercised before attempting to harness natural forces of such magnitude as exist in the flow of the St. Lawrence River. Too radical a disturbance of the balance which Nature seeks to maintain may cause disaster, hence it is well to emphasize this phase of the problem, for it involves basic physical factors of paramount importance.

Where very large developments of power take place it is usually necessary to have some industries, such as the electrochemical, take large blocks of power. These industries require cheap power. As the demand for power increases for municipal and small manufacturing purposes the experience has been that the demands for




POWER SITES ON ST. LAWRENCE RIVER

the power for such uses become so urgent, and the inducements by way of price so attractive to the vendors of such power, that large industries which were attracted by the cheap power have been compelled to go farther afield. A block of power—over 65,000 hp.—such as is exported from the Cedars plant in Quebec to the aluminum works at Massena, N. Y., would be sufficient, speaking on a broad basis, to supply light and power to some thirty-five manufacturing cities of 10,000 inhabitants each. It will be apparent from a comparison of the benefits resulting from power thus widely distributed and the localized benefits from the same power utilized in bulk, as in electrochemical industries, that the former contributes in a much greater degree to the upbuilding of communities and to the growth of the country at large.

There is strong opposition, especially throughout Ontario, to any policy which permits the exportation of

electric energy really required for use in Canada. The federal government has been memorialized upon this subject. It has been urged that no large power projects, such, for example, as those on the international portion of the St. Lawrence River, should be developed without reserving Canada's share of the power for use there; and, further, that powers situated wholly in Canada should be reserved against the day of Canada's need. This statement is made having in mind the fact that it is not the policy of Canada to embargo her exports, but that commodities of national importance should not be exported without an adequate *quid pro quo*.

### Power Sites

On the St. Lawrence River below Lake Ontario the first site where development involving the whole flow of the river could be made is in the vicinity of Morrisburg. With a dam near the foot of Ogden Island, a head of about 11 ft. could be obtained, or, by taking in a portion of the Galop Rapid, it has been thought possible to obtain a total effective head of about 15 ft. It is at this Morrisburg site—the Rapide Plat—that the New York & Ontario Power Company develops power in a small plant at Waddington, N. Y., under rights extending back for one hundred years. This company desires to reconstruct this plant and increase the development, thereby providing power for disposal in the United States as well as in eastern Ontario. The company offers to have this project made conformable to any scheme for the development of the river as a whole.

The next possible development is that at the Long Sault Rapids, where the possible head is variously estimated to be about 35 ft. to 40 ft. This is the site near Cornwall where the Long Sault Development Company, a subsidiary of the Aluminum Company of America, intended to erect its dams had not its charter rights been canceled by the State of New York—a cancellation which was confirmed by the Supreme Court of the United States.

Descending the river, in a stretch of about 14 miles between lakes St. Francis and St. Louis there are three series of rapids: the Coteau, the Cedars, the Split Rock and Cascades. The Coteau site is the one for which the Power Development Company, Ltd., has been seeking rights. Reliable assurances, however, have been given that rights for this development cannot be obtained without full public notice and discussion when all interested parties will have opportunity to be heard.

The Cedars Rapids Manufacturing & Power Company utilize at Cedars Rapids a head of about 32 ft. developed by means of a diversion canal some two miles long. The power house has been designed for an ultimate development of 180,000 hp. This company exports some 65,000 hp. to Massena, N. Y.

The Soulanges plant of the Civic Investment & Industrial Company is situated a short distance below the Cedars plant. Power is obtained by tapping the Soulanges Canal. The head is 50 ft. (15 m.).

The St. Timothée plant of the Canadian Light & Power Company is on the south side of the St. Lawrence directly opposite the two last-mentioned developments. The water is led through a portion of the old Beauharnois Canal. The head is 50 ft. and the development has an ultimate capacity of 75,000 hp. There are also small plants like those at Mille Roche and near Morrisburg.

To summarize, the estimated low-water power of the international portion of the St. Lawrence River may be placed at about 800,000 hp., of which Canada is entitled to one-half, or 400,000 hp. The potential low-water power on the portion of the river which lies wholly within Canada would be 1,400,000 hp. This, with its share of power along the international boundary, makes an estimated total for Canada of 1,800,000 low-water continuous horsepower. It is detailed in the following table:

WATER-POWER ON THE ST. LAWRENCE RIVER*
(Tentative Schedule)

| Site | Head Available | Estimated Low-Water 24-Hr. Hp. | Average Estimated 24-Hr. Low-Water Hp. |
|---|---|---|---|
| Morrisburg-Rapide Plat | 11–15 | 170,000– 230,000 | 200,000 |
| Long Sault Rapids | 30–40 | 500,000– 650,000 | 575,000 |
| Coteau Rapids | 15–17 | 230,000– 260,000 | 250,000 |
| Cedars Rapids† | 30–32 | 490,000– 525,000 | 500,000 |
| Split Rock and Cascades Rapids | 14–18 | 220,000– 280,000 | 250,000 |
| Lachine Rapids | 20–30 | 300,000– 450,000 | 375,000 |
| Total | | 1,910,000–2,395,000 | 2,150,000 |

* In this table, to have the estimates fairly representative of the possible quantities which might be expected under representative low-water flow conditions, some allowances have been made for efficiency and other factors.

† Under development for about one-third of the low-water flow of the river. Consideration would be given to the possibility of combining the Coteau, Cedars, Split Rock and Cascades; also of increasing the Lachine power.

The above estimate, excluding ice conditions, is conservative. Under a "diversity load factor," such as is experienced by the Hydro-Electric Power Commission of Ontario, Canada's 1,800,000 hp. would take care of a power demand of some 2,400,000 hp.

Canada's share of this power belongs respectively to the provinces of Ontario and Quebec. The federal government has the rights in and jurisdiction over navigation. When the time comes for international questions in connection with the development of this river to be adjusted to admit of proper development, there is no doubt that the various interests involved, whether federal, provincial, corporate or private, will, respectively, be fully taken care of. Perhaps, for example, some arrangement may be made by which the federal governments shall provide the dams for navigation purposes, making available for each province its share of water power under an arrangement by which the provinces would assume such financial and other responsibilities as were purely incident to the power assets.

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THE Priorities Division of the War Industries Board recognizes the whole-hearted support accorded by the industries of this nation to the regulations governing priorities promulgated during the period of active hostilities and expresses its deep sense of appreciation of that united coöperation. The public interest, as well as the interest of the individual industries, demands that the flow of materials, equipment, supplies, fuel, transportation and labor which has heretofore been diverted to war industries should now as promptly as possible, without unnecessarily disturbing the equilibrium of industry, be rediverted to its accustomed and normal channels.—*Edwin B. Parker, Priorities Commissioner.*

# Viewing the Problems of Reconstruction

## Representatives of Manufacturers and Central Stations Contribute to the Presentation and Hopefulness of Views on the Outlook—A Wide Range of Issues Is Seen as the New Era Unfolds

THAT it is a time of change, but that the changes mean on the whole a large demand for electrical energy, large demand for industrial and household apparatus and supplies, is the indicated viewpoint of statements to the ELECTRICAL WORLD.

### MOVE SLOWLY IN WORKING OUT NEW PROBLEMS

Sydney W. Ashe, educational and welfare department of the General Electric Works, Pittsfield, Mass., said to the ELECTRICAL WORLD:

"In considering reconstruction we should remember that intensive coöperation, supplemented with thrift, discipline, unusual effort and sacrifice, won the war for America. The problem of reconstruction must be worked out along similar lines. Much thought must be given immediately to reducing the high cost of living. If the cost of living remains high and a surplus of labor is created, the country will face a serious situation. People must be encouraged to continue to produce food, to buy in bulk and to conserve. Reducing the cost of living is paramount.

"In addition to easing the food situation, we must give more attention in our organizations to equalizing wages for similar tasks. It is not so much the rate of pay which an employee receives that causes discussion, but how this rate compares with that of other departments doing similar work. If in one department doing semi-skilled work the wages are high owing to a shortage of help and nothing is done to create an additional supply of help by training additional employees. this one department may throw the whole organization out of gear. We need a largely increased use of factory training schools, schools which are flexible and which may be used to equalize the distribution of help, besides giving a sufficient training before placing new employees on production. In other words, equalize the distribution of labor and reduce shop inefficiency.

"Then, again, time itself is a cure-all for many ills, and we must move slowly in working out new problems, having confidence meantime in the natural vitality of our country."

### "FROM DAY TO DAY"

A letter to the ELECTRICAL WORLD from an official of extensive operating and executive experience says:

"In the absence of a precedent, it seems to me the situation as to future demands on our industries has hardly developed far enough for us to comprehend what we have to meet. When we begin to get some vision of the conditions in Europe, from which during the past years the news has been so strictly censored as to give us little actual information, and we further know more as to the stability of the governments in Russia, Germany and Austria and something of the financial arrangements involved in peace terms, we may be able to form some conception of the industrial problem we have to meet and some idea of the time element involved.

"Until we do get a comprehensive view it seems to me that all that can be done is to follow such steps as from day to day appear sound. There may be individual industries where the course will be more clear.

"I think everybody is practically agreed that industry will require time for readjustment, but I do not believe as much time will be required by the electrical industry as by others, for the reason that other industries must have power while they are in operation. The use of power will probably drop off rapidly with the cessation of war activities, but as the other industries begin to manufacture on new lines they will require power, and the use of this power will be reflected in the earnings of the power companies some time in advance of the marketing of the manufactured products. There was a considerable lag in the advance of rates for power after the cost of operation began to overtake the gross revenue. I assume there will be a corresponding lag in the reduction of rates which will in a measure offset the curtailment of power.

"The power companies may have some spare plant capacity beyond their needs for a time, but they will have no large and useless inventories to scrap, so that on the whole they have little to fear. The efforts made by the government in the direction of conservation of power have shown the necessity of the central station to an extent that years of advertising by these central stations could never have accomplished. When the industrial readjustment is completed it seems to me the activity is likely to be as great as during the period of the war, although on somewhat different lines."

### PROBLEMS FOR THE MANUFACTURER

The great problems of the hour for the electrical manufacturer as seen by the president of an important Middle Western manufacturing concern are:

"1. Adjusting industry to the rapid cancellation of government orders actually taking place.

"2. Effecting the transition which is bound to come from war labor costs down to the inevitable necessities of peace operations.

"3. Adjusting material costs gradually down, so as to avoid a critical shrinkage of values, back to the normal costs of material for peace times.

"I see no reason why there should be any delay in the revival of full activity in the electrical industry, unless it be the impoverished condition of the central stations. The country as a whole appreciates their difficulties of financing, however, and I get the impression that the public service commissions are disposed to meet their necessities for advances in rates. This period of difficulty may possibly lead to one important change in central-station practice, namely, requiring the consumer to purchase all the equipment, including the supply transformer, essential to his needs.

"The capital requirements of the central stations, in view of the possibilities of rapid extension of use of

electrical energy, are going to make it good business on their part to throw as large a portion of the equipment costs on the customer as possible."

### SUCCESS RESTS ON LABOR AND CAPITAL

Another Middle Western manufacturer whose rapid achievement of success has been notable said:

"I believe the electrical industry should think accurately and fairly on the problems which are now before us as a result of the ending of the war. From our standpoint we see a wonderful future ahead if labor and capital will simply be fair to each other and try to stick together for the benefit of the whole country.

"In my opinion there is no question as to the markets available for manufacturers of electrical apparatus, both at home and abroad. We, although a small company, have found it possible to develop an export business in the past three years which is now much larger than our entire business was four years ago. As evidence of our faith in the export trade, I might say that we now have our own office at Rio Janeiro, a branch assembling plant at Osaka, Japan, a complete branch factory at Toronto, operated by our Canadian company, and we are planning to establish branch assembling or even manufacturing plants in South America, South Africa, France, and possibly Australia, within the coming year.

"The whole success of the big program, however, in my mind rests upon an adequate consideration and treatment of relations of labor and capital, with absolute fairness toward one another."

### UTILITIES SHOULD GET THEMSELVES UNDERSTOOD

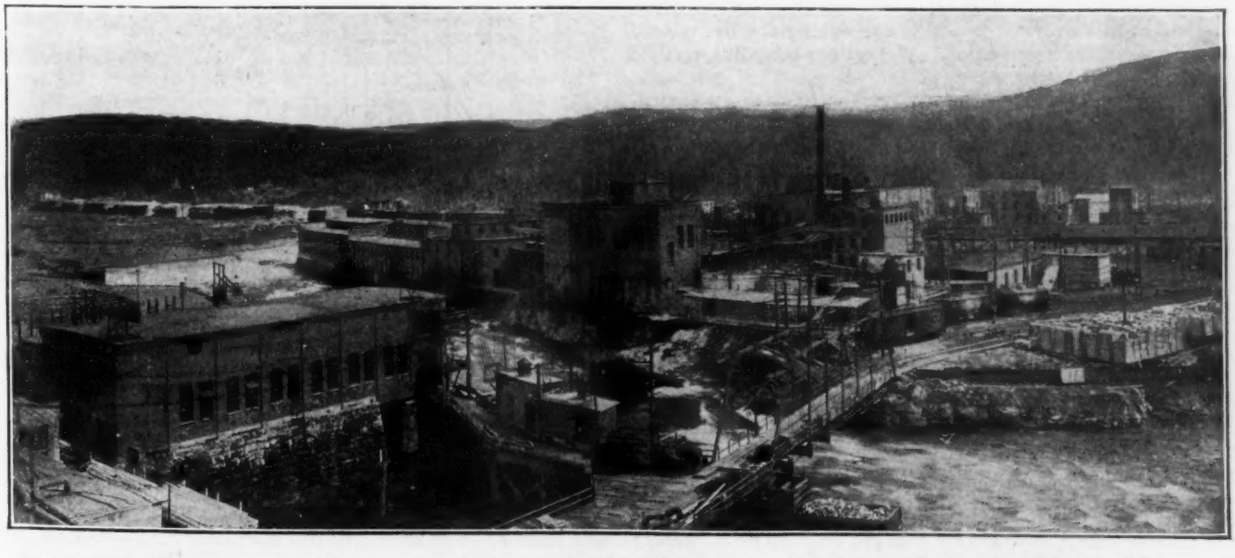
William E. Keily of Chicago, who is an observer and student of public utility relations, has made the following comment concerning one of the problems of utilities during the period of reconstruction:

"It seems to me that at this time the utilities should make an effort to get themselves understood. It is no use delving into the past for the cause, but while there are utilities and utilities, it does seem to be the fact that the public is mistrustful of some of the utilities —of the greed and lack of good faith that are alleged to characterize them.

"For their part, the utilities as a class may be said to be afraid of the public, or, more properly, of the governmental agencies of the public. The utilities seem to have an uneasy sense of insecurity in performing their very important work. They generally welcome fair and just regulation by the public, recognizing that such regulation should be made, but in very many cases they fear for their investment; the managers, laden with the responsibility of the interests of stockholders and employees, feel that their position and their desire to do right are not understood; they have some apprehension that the investment and jobs of those whom the represent will be taken away from them or curtailed in some way.

"Getting down to bedrock, therefore, it would seem that the public should endeavor to cast aside its suspicions and the utilities their fear. Let simple justice prevail. The utilities might say to the public: If it is really in the public interest that the utilities should not merely be controlled, but actually owned and operated, by municipal, state or federal government, so be it. But we declare our solemn belief that private ownership, subject to fair public regulation, is better for the people because it insures the benefits of private initiative, including careful management and continuity of management. In other words, Americans of energy and capacity work best when working for a stake depending on their own efforts. In this case the stake should be a reasonable return on private capital, sufficient to attract the brains that are necessary to the continued improvement and economical operation of the public utilities.

"The foregoing are simply some abstract observations relating to a very great and complicated subject. I simply express my personal belief that this is peculiarly a time when the public and the utilities should strive to understand each other with justice and good faith, the public putting away its old-time suspicions, and the utilities on their part meeting the public honestly and without fear."



IN PLANNING FOR THE DEVELOPMENT OF THE FUTURE, THE CENTRAL-STATION COMPANIES WILL GIVE CAREFUL ATTENTION TO NEW INDUSTRIES WHICH WILL PROMOTE THE INDUSTRIAL EXPANSION OF THE COMMUNITIES

# Removing Obstacles to Power-Factor Charge

## Necessity of Standard Method of Measuring Power Factor and Instrument That Would Be Universally Applicable—Examination Into the Methods That Are Now Employed in Widely Separated Plants

BY WILL BROWN
Electric Machinery Company

IF THERE were a standard method of metering power factor and a standard instrument which could be placed in universal use, it would be a fairly simple matter to base rates on power factor. As the situation stands, however, it is by no means a simple matter. Nevertheless, it must be done, and the numerous examples quoted below are proof of the fact that it can and will be done.

Periodic tests made with portable power-factor meters constitute a method very commonly employed, as indicated by the following statements from central stations:

*Milwaukee Electric Railway & Light Company.*—The company has no one instrument to determine the average power factor. It is determined by voltmeter, ammeter and wattmeter tests, when it is apparent that the power factor is low.

*Wilkes-Barre (Pa.) Company.*—We use ammeter and voltmeter readings to determine power factor of customer's load.

### Graphic Power-Factor Meters

Quite a number of companies use some form of curve-drawing power-factor meter. The following examples are typical:

*Wisconsin Power, Light & Heat Company.*—The power factor of any customer's load, where we have any doubt as to its being maintained at the proper figure, is tested by temporarily installing the necessary graphic power-factor meter.

*Rome (N. Y.) Gas, Electric Light & Power Company.*—The graphic power-factor recording instrument which we have in use has a chart 60 ft. (18 m.) long and an eight-day movement. The instrument is of a switchboard type with all the resistances mounted on pipe framework in order to make it portable. It is our plan to connect this with each power customer for a week at a time as often as necessary and secure the average power factor during the heavy load for the week from the chart. We believe that this method would be sufficiently accurate for all practical purposes. Of course, it would be more convenient to have an instrument at each installation if the company felt warranted in going to the necessary expenditure.

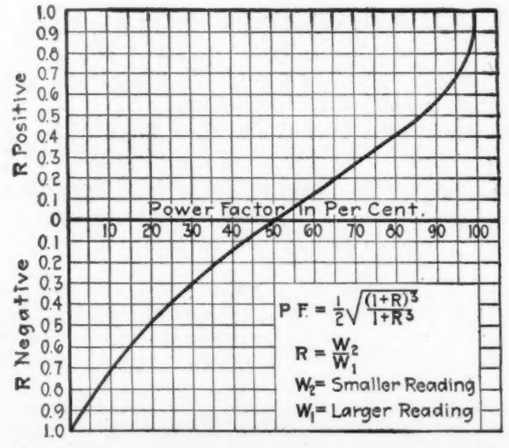
The power companies in the Niagara district have made extensive use of graphic power-factor meters. There are probably more graphic power-factor meters installed in this district than in any other part of the country. The Niagara, Lockport & Ontario Power Company states that it uses a graphic recording power-factor meter installed on switchboards of all large power consumers. The power factor obtained at the time that the demand meter registers the maximum energy demand is used for computing 90 per cent of the kva. demand at that time.

The following power companies are getting reasonably satisfactory results from the use of graphic power-factor meters: Harrisburg (Pa.) Light & Power Company; Edison Electric Company, Lancaster, Pa.; Mahoning & Shenango Railway & Light Company, Youngstown, Ohio; Shenango Valley Electric Light Company, Sharon, Pa.; New Castle (Pa.) Electric Company; Pennsylvania Power Company, Ellwood City, Pa.; Republic Railway & Light Company, Youngstown, Ohio; Rochester (N. Y.) Railway & Light Company; Empire Gas & Electric Company, Auburn, N. Y.; Richmond Light & Railway Company, New Brighton, N. Y.; Northern Indiana Gas & Electric Company, Hammond, Ind.; Claremont (N. H.) Power Company; Northern Ohio Traction & Light Company, Akron, Ohio, and others.

It can be said for the graphic meter that it does give a fairly accurate history of the customer's power factor over a stated length of time. The person who examines the chart must have a good idea of the size and characteristics of the customer's load before he can make intelligent use of the information which the chart supplies, however.

### Two Single-Phase Watthour-Meter Methods

Some of the best examples of rate making based on average power factor are found in Canada. In the heavy power districts of which Toronto and Montreal are the centers the power companies use two single-phase watt-hour meters. One meter is connected to record true energy while the other is connected with its potential coils reversed. The power factor is derived from the formula $\sqrt{3}B \div 2A = \tan \theta$, wherein $A$ is the indication or record of the standard connected meter, $B$ that of the reversed instrument, and $\theta$ the angle whose cosine is the power factor. This method of me-




POWER FACTOR OBTAINABLE FROM RATIO OF WATTMETER READINGS

In a three-phase, three-wire circuit, the power factor can be calculated from the readings of two wattmeters connected in the standard method for measuring power, as follows: $[(W_1 - W_2)(W_1 + W_2)]\sqrt{3} = \tan \theta$, where $W_1$ is the larger reading which is always positive, and $W_2$ is the smaller reading, which may be either positive or negative. The method is good for balanced loads.

tering can only be used where the three phases are balanced.*

The following extract from a contract of the Montreal Light, Heat & Power Company refers to another method of using two single-phase watt-hour-meter readings:

The minimum monthly average power factor of the electrical energy taken under this contract shall not be less than 85 per cent, and it is to be determined monthly from the ratio of the readings of two single-phase watt-hour meters. If the power factor of the electrical energy taken under this contract is found to be less than that specified, then the consumer shall pay for the electrical energy taken on the basis of the minimum power factor as specified herein.

In applying this ruling the power factor is readily obtained by the use of a chart like that shown herewith. So far as practical results are concerned, the method of billing and metering described seems to be the most accurate and practicable yet employed for this purpose. A clerk with no technical experience using this chart can figure out the average power factor of the customer's loads, and the whole thing becomes a simple matter of routine bookkeeping. Nothing is left to chance, and it can be seen that all the possibilities of error, such as the human element naturally involves in power-factor tests, etc., are avoided. It is interesting to note that the average power costs in the districts where this method of determining the power factor is used are very low.

Companies in the United States making use of two single-phase watt-hour meters on three-phase systems have the following to say:

*Penn Central Light & Power Company, Altoona, Pa.*—Average power factor as defined by kw.-hr./kva.-hr. is calculated by our company from the readings obtained from two single-phase watt-hour meters over the period of time in which the power factor is to be determined, tests having been made to prove that the load and voltage are balanced across the three phases of the three-phase installation. We also use graphic power-factor meters for this work to some extent, where power factor for very short periods is in question.

*Central Power Company, Canton, Ohio.*—We use the readings of two single-phase watt-hour meters and also power-factor indicators.

*Trinidad (Col.) Electric Transmission, Railway & Gas Company.*—On all our large installations where we desire to keep tab on the power factor we use two single-phase watt-hour meters. Two single-phase meters will give the average power factor for any one day, week, month or period, as desired.

*Toledo (Ohio) Railways & Light Company.*—Our method of metering is to use two single-phase watt-hour meters or ammeter and voltmeter with wattmeter.

The Cleveland Electric Illuminating Company usually makes its power-factor tests by single-phase integrating watt-hour meters set for a week or ten days.

A prominent authority on meters says:

The question of just how the charge for the service shall vary with power factor is a broad one and must necessarily depend upon the devices for measuring power factor. A device for determining kilovolt-ampere-hours as well as kilowatt-hours would be ideal in determining this matter, but unfortunately we have as yet no device which will determine kilovolt-ampere-hours. The nearest thing is the use of two wattmeters, as is apparently being done in Toronto and Montreal. This gives the average power factor over the entire period, but does not give the power factor of the maximum demand, which is really of more importance than the average power factor, since it is that quantity which fixes the amount of the equipment necessary to serve the customer.

"I have in mind a method of obtaining kilovolt-ampere-hours, but the device for measuring this quantity is not yet developed. I hope to be able to devote some study to this device in the near future, and if anything comes from this study, the device will undoubtedly be marketed at some future date."

### Effect of Power Factor on Cost of Energy

Professor Arno has expressed the opinion† that consumers ought to be charged for the energy actually consumed and metered and in addition ought to pay for a certain fraction of the difference between the amount consumed and the apparent amount consumed, which is the product of volts and amperes. This fraction would vary according to the circumstances and may be anything between a quarter and a half. Let us take it as one-third. Then a little calculation will show that the consumer will pay for two-thirds of the power actually supplied, together with one-third of the power apparently supplied.

Professor Arno's method of using meters to carry out this idea is described in the Swiss patents Nos. 55,774 and 55,973 and is somewhat as follows: A Ferraris system of meter is used. He proposes to displace the driving active field due to the volts with respect to the driving active field due to the current by a certain angle in a backward direction. This angle would be greater than 90 deg., and its precise value would depend on the variations of the phase displacement with which the meter was expected to deal. It would thus be likely to have values between 100 deg. and 114 deg. This meter would then give the reading of the amount of power for which the consumer has to pay directly. If the load is free from induction, the results are exactly the same as those given by a power meter; if it is inductive, a higher reading is given.

But there are objections to this method. The readings are not given in the lawful unit, the watt, but in a complex unit, which is difficult to explain. In some countries such proceedings are illegal. These meters give no idea of the power actually taken from the mains, which is a disadvantage from the management point of view; in fact, it is difficult to tell how the network is working unless the power put into and taken out of the network is known. And, apart from the question of explaining the system to the consumer, there may be many cases in which it would be still more difficult to justify the results. Thus, a man might obviously reduce his intake and yet find that, owing to a change in the power factor, his bills remained the same as before. Further, if a meter had been adjusted so as to read according to a certain fraction, say, one-third, of the apparent power, it could not easily be changed so as to allow for one-quarter, even if the conditions demanded such an alteration. Once the fraction or angle of displacement has been fixed it cannot be altered. If the character of the load were to change in the process of time, and

*See ELECTRICAL WORLD, Jan. 19, 1918, p. 140, for accurate measurement of power factor on unbalanced loads.

†Abstract of an article in the *Elektrotechnische Zeitschrift*, Heft 39, 1915.

motors were gradually added to a lighting load, or a predominantly lighting load, a meter which read properly for power factors between 1 and 0.8 would be wrong for conditions where the power factor varied from 0.9 to 0.5, as might well be the case with a motor load. Neither is the "complex" meter so good as the ordinary type in respect of the magnitude of the torque, the no-load current and simple means of calibration.

The disease of low power factor is insidious, and its victims are frequently unaware of the fact that they are sufferers. Very few of them will deny the evil effects of low power factor. They will all readily agree that the other fellow is suffering from it, but they simply don't wake up to the fact that the thing is right in their own plant. That is the reason so many evils have been allowed to grow to large proportions. In the future every user of electric power must recognize that proper consideration of power factor is an obligation which he owes the community.

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## REHABILITATING A SMALL CENTRAL-STATION SYSTEM

### Conditions That May Be Found on Small Systems and How They Were Improved in One Case Without Great Expense

BY LEO LUSTIG
Electrical Engineer Compañia Central de Electricidad y Traccion, Ciego de Avila, Cuba

OWING to the great increase of connected load and previous unsystematical extension of lines and addition of transformers, the Compañia Central de Electricidad y Traccion in Ciego de Avila, a Cuban city of about 16,000 inhabitants, had to redesign and reconstruct its entire distribution system to serve its loads. As in many smaller plants, and especially in countries like Cuba, where intelligent help is relatively scarce, the extension of lines was done by simply using wire which was at hand and by increasing the size of transformers or adding a new one, generally a very small one. Distribution was accomplished by three-phase feeders operating at 2300 volts and by single-phase transformers with 110-volt secondaries. No care was taken to balance loads on the generators, which had twice as much current in one phase as in the other two in some cases. Even worse conditions existed on feeders. Some transformers were greatly overloaded (120 per cent), while others carried hardly 25 per cent load. The secondary distribution system consisted mainly of Nos. 8, 10, 12 and 14 wire, of which more than 1500 lb. was later taken down. Owing to the fact that soldering of wire connections was the exception rather than the rule, the voltage drop was considerable, the voltage being as low as 60 volts in many places. The differences in voltage were very large.

In remodeling the system it was the object to:

1. Obtain the best possible distribution conditions using the existing equipment.

2. Adapt the system to motor service. Up to that time the plant operated only at night for lighting service.

3. To establish a system of recording individual consumers' loads that could be used in preventing breakdown of transformers due to overload.

First, a plan of the whole distribution system was made and the consumers' connected loads indicated thereon by marks of different color. This map was used for redesigning the network and installing transformers as near as possible to the centers of load. Between 7 p.m. and 9 p.m., which happened to be the most important period in this case, the transformer and line loads and voltages were measured. After the transformers were reconnected to meet the conditions observed the loads on the generators and feeders were balanced within 5 or 10 per cent. This in itself was of considerable benefit. In many cases 10 to 20 volts increase was gained by simply reconnecting a part of the secondary circuit of one transformer to another transformer more centrally located.

These rules were observed in redesigning the line:

1. Allowing for a 50 per cent increase in the lighting load over the expected load at the end of the reconstruction, no larger than 2 or 3 per cent drop was allowed in the secondary lines up to house connections.

2. All 1½-kva. and 2-kva. transformers were discarded, keeping the smallest size (3 kva.) for single-motor loads, with a view to discarding even these in future and standardizing 5, 10, 15 and 20-kva. sizes. By doing this the investment in transformers and protective apparatus can be minimized, the maintenance expense made smaller and the transformer rating can be reduced owing to a larger diversity factor. There are now thirty-two transformers, having a total rating of 187 kva., with a connected lighting load of 270 kva.

3. For secondary distribution 2 × 110 volts was employed for all principal street mains, three wires with a neutral of about half size being used. The load was distributed so that it would be balanced under normal conditions and provision made for keeping it balanced. By making this change it was possible to use fewer and larger transformers, to use some parts of old line by adding a neutral, to reduce thereby the losses to one-quarter, and in general to keep the drop in voltage within acceptable limits without using prohibitive amounts of copper.

4. Arrangements were made for serving motors by connecting a transformer to the nearest light transformers and joining them in open delta. When the motor load increases or becomes more distributed the delta connection will be closed and the secondaries of adjacent transformers banked.

For keeping track of the loads on the distribution transformers and to insure balancing, loose-leaf records were made, a sheet or two for every 120 blocks (approximately). On these were noted the number of the house (or indentification number), name of consumer, connected load in lamps, watts or some other manner, and street. Space was left for remarks regarding interruptions of service, etc. Transformer cards were also prepared and a map of the particular transformer circuit was attached to each. On this card are the transformer rating, its phase position on the circuit, name of the circuit, location number, maximum permissible connected load, and load factor. Columns were also provided for marking connected load on each side of three-wire line, for total load, for the number of consumers, and average connected load. Space was left for test and interruption records.

Each change in connected load is recorded daily in

the consumer's book and on the transformer card and plan. Most of the records are written with pencil, but the yearly records and test record are entered in ink so that the card and plan can be used for considerable time. When recording the change in load it can be observed at a glance if danger of overload or unbalancing is imminent. As there are not more than four changes a day on the average, the recording does not require more than five minutes a day.

The mechanical part of reconstruction was a big item. In the old system the transformers were mounted on the tops of the poles between primaries and secondaries. In remodeling they were mounted below the secondaries at a height of about 18 ft. (5.5 m.) above the ground so that they were easily accessible. The 15-kva. and 20-kva. transformers were provided with a platform. Fuse receptacles and lightning arresters were placed on the upper transformer cross-arms. Only soldered connections were made.

Poles were relocated, as before rehabilitation they were haphazardly placed, some being 60 ft., others 200 ft. (18 m. to 60 m.) and more apart. House connections were made in the standard way, either by tapping at pole insulators or from distribution wires inside the portals. The houses have portals almost without exception. These circuits were fed in the normal way by connecting branches at the pole insulators. Formerly the house connections were made at almost any place on the secondary line between the poles. Almost all line material taken down could be used again, and the entire work was done without interrupting service.

Ciego de Avila is the first city in Cuba where such remodeling has been undertaken. This result is due to the progressive policy of the company's vice-president, Manuel A. Cadenas. Similar and even worse conditions can be found on many other systems in Cuba.

Not only were the losses minimized and better use of equipment obtained, but the service was so improved that many consumers who were on the verge of discontinuing the use of service were induced to continue it, and in addition many of them increased their consumption.

# Safeguarding Electrical Employees

## How Companies Which Take an Active Interest in the Wellbeing of Their Employees Have Made Use of Protective Devices to Guard Against Personal Injuries—Care and Testing of Rubber Goods

THE electric light and power industry has always been forward in safeguarding the lives of its employees. In perhaps no other business is the "safety first" movement promoted with greater zeal. Now that the war has taken such an awful toll of human lives, it is important that still greater precautions be taken in protecting life under peace conditions. To assist in this work as it is related to the electrical field the ELECTRICAL WORLD has investigated practices in the use and care of rubber goods for the protection of electrical workmen on both overhead and underground lines and in station work, and it here presents its findings. The data and opinions given represent the results of inquiries addressed to forty-eight companies in the United States and Canada. Among these companies are organizations which have been studying and practicing the most improved safety methods for many years.

Among rubber goods which companies use regularly for protecting men are rubber gloves, linemen's shields, rubber blankets, hose, rubber armlets, rubber boots and shoes, rubber coats and hats. Rubber gloves are used almost universally. Linemen's shields are also in general favor, a few companies using blankets and hose in combination instead of shields. The more common use for blankets, however, is on work at lower potentials. The armlet is a somewhat unusual device. It is made of the same material as rubber gloves. It is worn on the forearm and extends from the wrist to the elbow. The use of rubber wearing apparel seems to be governed partly by the climatic conditions under which different companies operate and partly by the liberality of companies toward their men.

Of the forty-eight companies only four reported that linemen's shields were not used at all. The companies which do use them find them successful on all the more primary potentials as 2200 volts, 4000 volts and 6600 volts. In several instances they are employed as protection on 11,000 volts and 13,200 volts, and one company reports that it uses them continually on 14,000-volt circuits. There seems to be some difference of opinion, however, as to the advisability of using shields on these higher potentials, and some companies report that when working lines at such voltages the shields are used only to prevent loose ends of wire from whipping into the workmen.

Despite the fact that the use of shields is almost universal, no standard method of testing or of treatment of the shields seems to be in vogue. As long as the shields appear to be all right from inspection, it is general practice to use them until some especially favorable offer for trading them in comes from the manufacturer, at which time new shields are purchased. Some companies change their shields as often as every two or three years, but there are instances where the shields have been in service for more than eight years and are still doing good work.

### METHODS OF TESTING SHIELDS

In some instances where shields are tested the tests are conducted upon request only, there being no regular routine for the testing. The shield to be tested is mounted on a test bar which forms one of two electrodes. The other electrode is attached to the end of a stick and is carried over the surface of the shield. A potential of 50,000 volts is applied to the shield. Breakdown is discovered from the resulting arc. No tests are made previous to the acceptance of the shields from the manufacturer. One company states that during the last

two years about twenty shields have been tested with no failure.

Another method of testing shields which one company employs about every eight months is to place the shield on a wooden form the exact shape of the inside of the rubber shield. This form is covered with sheet lead $\frac{1}{32}$ in. (0.79 mm.) thick. The rubber shield is then

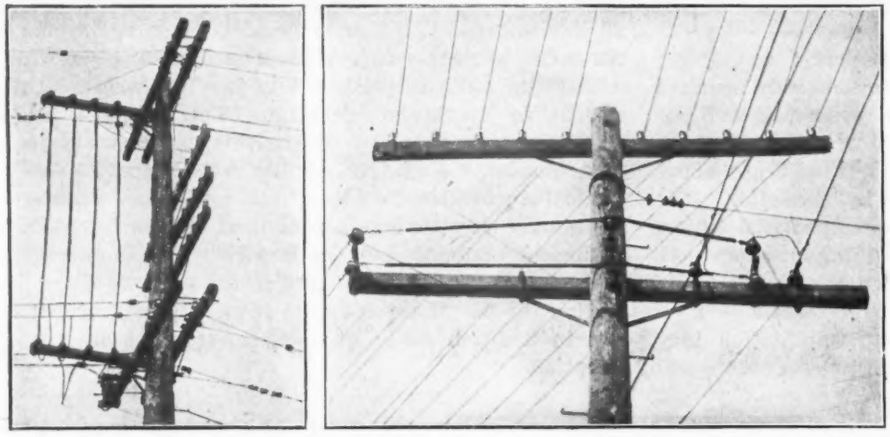

FIG. 1—RUBBER HOSE PREVENTS CONTACT WITH CIRCUITS WHICH LINEMAN HAS TO PASS

placed over this, and another sheet, $\frac{1}{32}$ in. thick, is placed over the rubber and the testing electrodes are applied to the two lead sheets. The shield is thus subjected to a potential of 10,000 volts for one minute.

Linemen's shields are sometimes subjected to what is called a submersion test once a year. The potentials used in this test vary all the way from 11,000 volts to 30,000 volts.

The shields are usually carried on the construction truck, the standard complement per truck consisting of from three to twelve shields on heavy construction wagons and from two to four shields on light construction wagons. Heavy trucks usually have not less than six shields and light trucks about four shields. There seem to be two approved methods of carrying the shields. On consists of stringing ropes along the top of covered wagons and suspending the shields on these ropes, as they would be suspended on a wire. The other means is to use especially constructed boxes to hold them. In some instances these boxes are carried on the flat top of the truck bed; in other instances arrangements have been made to stow the boxes under the chassis and thus utilize room which otherwise would be of no service. In practically all instances some precaution for ventilating these boxes is taken which will admit air without permitting water to enter. In case the shields become greasy through contact with truck axles or through other accident it has been found advisable to clean them with gasoline. But in so doing care must be taken that the shield is rubbed dry to remove all traces of gasoline before it is stored away.

In a few instances rubber blankets about 30 in. (75 cm.) square are used in place of shields. One of the companies employing blankets in this way has submitted the following report of its practice:

"Rubber blankets are used when working on or near the lines the potential of which exceeds 300 volts but does not exceed 4000 volts. Work on lines of over 4000 volts is always carried on with the lines dead and grounded. We cannot say at what potentials the blankets are successful, except that we have experienced no trouble in using them on the potentials mentioned. We have a rule forbidding the men sitting on the blankets. They are placed in position as a warning signal and as a safety device for protection in case the workmen accidentally back into or fall against the live parts. Several methods have been employed for fastening the blankets in place, the objection to most of them being that they permitted the blankets to slip around, thereby exposing the wire or other live parts. Our present practice is to use special wooden blanket fasteners similar to large spring clothespins. A heavier type of blanket is used for manhole mats, and where it is absolutely necessary to stand on top of transformers. The latter practice is discouraged as much as possible."

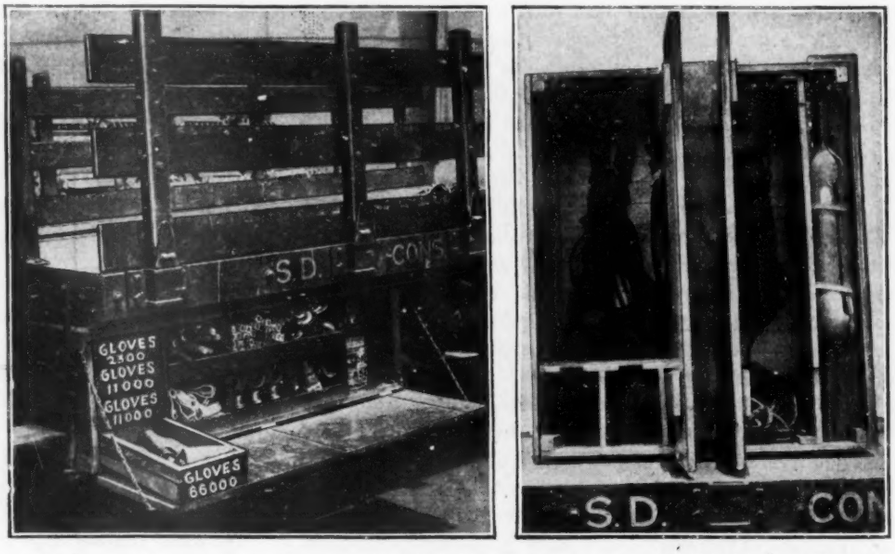


FIG. 2—RUBBER GLOVES KEPT IN DRAWERS UNDER TRUCK, AND LINEMEN'S SHIELDS IN BOX ON TOP

One company which uses rubber blankets on station buses and switchboards finds them successful up to 11,000 volts. They are fastened in place by cords and wooden strips. Another company punches eyelets in the edges of the blankets, so that they may be tied in place with marlin.

Blankets are not folded when they are stored in the

trucks which carry them but are rolled around a piece of hose. Each blanket is rolled separately, so that each will get the same average amount of use. The standard complement of blankets where they replace shields is the same in number as the shields.

The usual method of testing blankets is to place them between two flat electrodes each having 1 sq.ft. (930

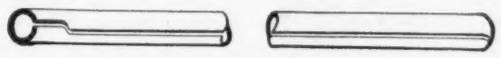

FIG. 3—METHOD OF SLITTING HOSE TO HOLD ON CONDUCTOR

sq.cm.) of surface and to apply potential between these plates. The potential employed is usually 10,000 volts, and the time for which the blanket must withstand this potential is usually at least one minute. One company applies 15,000 volts for five minutes to blankets used on 13,200-volt circuits. Accurate records of the length of life of blankets are not available, but it is asserted by some companies that they should last at least one year. One company has found it can vulcanize patches on blankets successfully after they have been snagged.

### How Rubber Hose Is Used for Protection

The methods of using rubber hose for protection may be divided into two general classes—first, the method which employs it for temporary protection of men working on lines, and, second, the method which places the hose permanently on all circuits that might need covering if men were climbing poles. The companies which use the former method have found it successful. The hose is cut into 3-ft. (90-cm.) lengths, either being split spirally or cut as shown in the accompanying sketch to keep it from falling off the wire. When the hose is new the lips at the end of the hose are sufficient to hold it in place. After the hose has been in use some time it becomes more flexible, and it is then necessary to wrap the ends and the middle with a few turns of friction tape as an extra precaution against its slipping off the wire. Some linemen even make a practice of using this tape with new hose. No instances were reported in which hose was used on potentials above 6600 volts.

Companies which issue hose to linemen usually consider that not less than eight pieces of hose should be

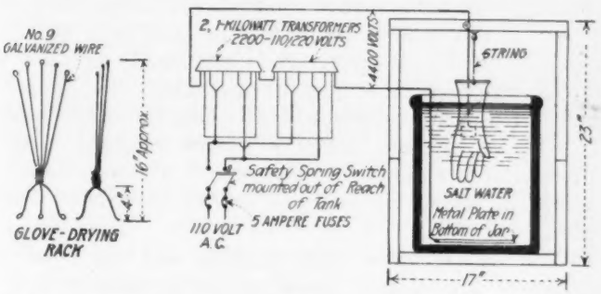


FIG. 4—METHOD OF TESTING GLOVES, WITH RACK FOR DRYING

carried on heavy construction trucks and not less than four pieces on service trouble and repair trucks.

Other companies install hose on primary wires at transformer poles leading from the primary mains down to the transformer. This practice is sometimes followed on 2300-volt, 4000-volt and 6600-volt lines and is found successful at these potentials. If the hose is installed when the transformer installation is made, it is of course not necessary to split the hose. If the hose is installed on an old installation, it is split and placed over the wires. It is then wrapped with No. 20 copper wire at intervals of about 2 ft., and the copper wire is then covered with friction tape.

### Rubber Gloves Extensively Used

Of all the rubber goods in use by electric light and power companies, rubber gloves are perhaps the most numerous and most universally employed. Gloves are employed on all potentials up to and including 13,200 volts. Unlike the practice in the case of shields, blankets and hose, practically all companies have adopted methods of periodically testing gloves. Usually the number of tests which are applied to rubber gloves depends upon whether the gloves to be tested are samples submitted for future consideration or whether they

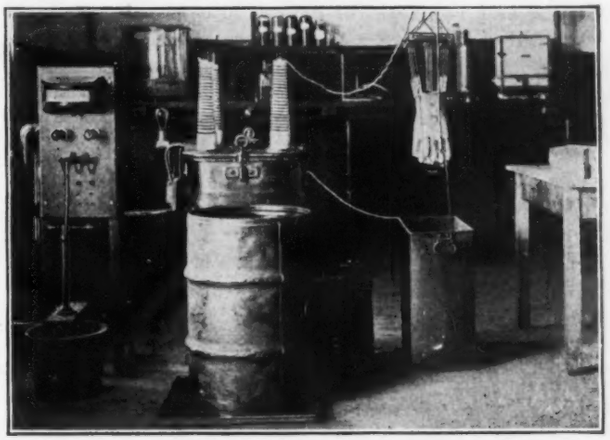

FIG. 5—HIGH-TENSION TRANSFORMER AND GLOVES READY FOR IMMERSING TO TEST

are a shipment of an accepted grade of gloves. The tests of the samples is naturally more extensive than the routine tests made on rubber goods.

The following is a description of one of the so-called sample tests:

The gloves after being weighed are filled with water and suspended in a tank of water for a dielectric test. A flexible chain placed inside the gloves forms one terminal, and the tank itself the other. A potential of 4000 volts is then applied and the leakage measured. The gloves are kept at this voltage for one minute. The voltage is then raised until the gloves break down. This, of course, gives the maximum voltage the gloves will stand. The potential at the time of puncturing divided by the thickness of the glove in mils, at the point of failure, gives the volts per mil, which is used for comparison.

The object of the next test is to determine the mechanical properties of the rubber. This is accomplished by placing a sample of the rubber in the jaws of a machine which gradually stretches it until the load reaches a certain predetermined amount, when the load is gradually reduced and the rubber allowed to contract. This cycle of operations continues automatically until the rubber breaks. At the same time a curve is drawn on paper which shows the relation between load and elongation. The test is known as the hysteresis test, due to the fact that for any particular load the elongation on the stretching portion of the cycle—that is, when the load is applied—is less than the elongation for the same load on the contracting portion, or when the load is being removed. In other words, there is a lagging condition which is exactly analogous to the phenomenon of hysteresis.

A study of these curves indicates the relative pliability, strength, elasticity and other properties of the rubber, a knowledge of each of which is necessary in selecting the best glove. It has been found, for example, that if the rubber can be stretched too many times before breaking, it is too highly vulcanized and is just as bad for the gloves as rubber which has not been vulcanized enough.

Snagging tests are also made on samples of gloves to determine their strength and toughness. The test is made by clamping a sample of the rubber about 1 in. (2.5 cm.) in diameter in a machine so that the entire circumference is securely fastened. A small blunt plunger is then gradually forced against the center of the sample until the rubber is punctured. The pressure the rubber will stand, as indicated on the curve drawn, is a measure of its snagging-resisting qualities.

An ash test is made to determine the amount of solid matter, and this is the last test.

### ROUTINE TESTS

The routine tests on shipments of gloves are as follows: (1) inspection, (2) weight, (3) leakage at rated voltage, and (4) test for one minute at rated voltage. All of these tests are made on each glove, with the exception that only four samples of each shipment received are weighed.

In addition to these tests the men in the field give them an inspection each time before using them. Holes in the gloves may often be found by taking hold of the top of the gauntlet with the fingers of both hands and whirling it around between the arms, thereby closing the end and pocketing the air. Very small pinholes cannot be found in this way and can only be located by immersing the glove in water.

Another common method of testing gloves is to fill the gloves with acidulated water and with shot to about 1 in. of the top. The gloves are then immersed in a jar of acidulated water to about the same distance from the top, and 10,000 volts is applied between an electrode placed in the glove in the shot and another electrode having a surface of about 1 sq.ft. (930 sq.cm.) in the bottom of the jar. The distance between the lower electrode in the glove is about 4 in. (10 cm.). The voltage is then applied for one minute, and if the current does not exceed 8 milliamperes or breakdown does not occur, the glove is approved for use; otherwise not.

Another company which is quite careful in testing its gloves states that in testing gloves the leakage current is taken into consideration, the maximum being 10 milliamperes at 10,000 volts. In testing the gloves this company has invariably found that the weakest part of the glove is in the crotch between the first finger and the thumb. At this point the gloves almost always run thinner than at any other point. This company has always found that where the thickness of the crotch is satisfactory the leakage current is never above the maximum.

Some companies during the last year or so have been experimenting with canvas, buckskin and horsehide gloves which are worn over the rubber gloves to prevent snagging. Almost every one who has tried this procedure concedes that it is an economical one. Still other companies which have tried it consider the use of the extra glove not economical, but very practicable, on account of the fact that it prevents snagging and hence is an extra safeguard for the man.

Rubber gloves should never be left in leather gloves over night. Taking the two sets of gloves apart prevents the rubber from deteriorating because of oil soaking through the leather gloves. In some cases the men wash their rubber gloves every other night with soap and water, which also helps to keep them in good condition. It is important that the leather glove be large enough to give plenty of finger movement. In the usual type of leather gloves employed the fingers and the thumb of the hand are entirely covered, but the back of the hand is left open. The leather gloves are usually of the ordinary length without gauntlets and are fitted with draw strings for tightening around the wrists.

According to the best information, it appears that the life of rubber gloves is a very uncertain thing. Some gloves have been known to last for two years, and others last less than two months. One company which regularly makes acceptance tests on gloves received from manufacturers states that between 1 and 2 per cent regularly fail to pass the test.

One company reports that gloves which are thrown out on account of defects brought out by electrical tests are turned over to the gas department for use by workmen as a protection for their hands against by-products which result from the manufacture of gas. With some companies periodic testing of all rubber gloves is done as often as once a week. Others think periodic tests every two months are sufficient.

### ASSURING USE OF SAFEGUARDS

After rubber goods have been supplied to the men in sufficient quantities and "safety first" rules have been made comes the problem of seeing that the goods are used. No rules can be laid down relative to the number of pieces of rubber goods to be used on each class of work. All parts whose potential is over 300 volts with which the men can come in contact should be protected. In other words, sufficient rubber goods of the various kinds must be used to make the conditions safe for the men to work. In order to accomplish this in some instances each man is made responsible for every one else he may be working with, and the foreman is responsible for the safety of the whole gang. If a man, for example, is working on hot wires, it is of extreme importance to another working with him that he be protected just as much as practicable, so that in case of trouble the second man will not be unduly exposed in coming to the assistance of the first. Failure on the part of any one to observe the proper precaution is usually reported by the observer. It is punishable by an enforced lay-off without pay or discharge, the punishment, of course, varying with the gravity of the case. This lay-off in some instances is even extended to the foreman of the gang. All companies, however, do not believe in laying off men for failure to comply with rules.

While shields, hose and blankets and the heavier equipment are usually issued as the standard complement for each wagon, gloves, coats, boots, etc., are usually issued to the men for their personal use. Some companies issue goods free, others charge the men cost prices. The men are usually instructed that they can turn in such goods at any time they consider them unsafe. This practice is seldom abused, but some companies find it expedient to keep a record of the dates on which goods are issued, in order to keep a check on possible abuse

# STATION & OPERATING PRACTICE

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

## METHODS THAT SAVED COAL IN CUBAN PLANT

### Savings Amounted to $20,000 a Year After Increases in Wages and Extra Expenses Had Been Met

BY HENRY G. FENTON

Owing to the cost of coal rising to three times its pre-war value in a southern Cuban plant of which the writer had charge, the coal bill became the dominating item in the cost of operating and every economy had to be practiced. All of the hands were either Cuban or Spanish, and at first they were very skeptical as to innovations. However, a study of the operating conditions showed that about 25 tons of coal per day should have been sufficient for the load, the actual consumption being from 30 tons to 35 tons. This was reduced to about 27 tons per day by the following changes:

The grate bars of all of the boilers were changed so that they had about $\frac{3}{8}$ in. (9.5 mm.) clearance between bars instead of $\frac{1}{2}$ in. (12.7 mm.) as before, thus eliminating many holes in the fire due to uneven air supply. The draft was reduced from about 0.70 in. (17.5 mm.) to 0.35 in. (9 mm.) by regulating the dampers. All of the settings were calked up with a mixture of fireclay and waste. Between boilers where there was not room for a man to enter iron plates were used to inclose the space and ashes were packed into the tops of the settings to prevent air from entering. The firemen were required to level the fuel beds with a tool made of a 1-in. (2.5-cm.) pipe with a "T" 20 in. (50 cm.) long on the end. It was found necessary to plug the handle of this and drill a few holes midway to allow the escape of the hot air inside. The soot was blown off the tubes by hand with a steam lance once in each eight-hour shift. The tubes were cleaned inside, when they were found to have $\frac{3}{32}$ in. (2.5 mm.) of scale in the lower tubes. The feed water was raised from 150 deg. Fahr. (66.5 deg. C.) to about 180 deg. Fahr. (82.2 deg. C.) by cleaning the heater and piping and changing the suction pipe from 3 in. to 5 in. (7.5 cm. to 12.5 cm.). This was later brought up to above 200 deg. by installing an economizer in the breeching, which had been made large to allow of future increase in capacity.

Draft gages were installed on each boiler and a portable gas-analysis set was purchased and a great many tests made to establish the best average draft to use. The thickness of the fuel bed was specified, and the men were taught to estimate it with some accuracy. The ashpits were kept wet and the fires were cleaned once on each shift, especially just before the peak came on. It was required that unnecesary boilers should be shut down promptly and disconnected from the steam lines at once.

The condenser of the turbine was cleaned each Monday, each tube being scraped out to insure a maximum of heat transfer, as the circulating water was of tropical temperature during the entire year. Along the bottom of the intake was found a cement-like deposit, several inches thick, which was removed at some expense with small bars and special shovels. It was floated out in small boats about 3 ft. (0.9 m.) long and a foot (300 cm.) or so wide, a little water being left in the pipe for this purpose. This improved the vacuum about $\frac{3}{4}$ in. (19 mm.). The bay was cleaned out near the intake by hand labor so as to allow cooler water to flow into the pipe.

Finally, the labor question was solved fairly well by requiring the shift engineers to remain habitually in the boiler-room, superintending the firemen and making periodical visits to the engine room, where the oilers took charge of the operating routine. One extra fireman was put on the peak-load shift and wages were raised from 10 to 15 per cent all around as soon as the saving in coal was definite enough to justify it, after which there was no tendency to object to the methods.

The total saving amounted to about $20,000 per year, owing to the extremely high price of coal, after the raise in wages and extra expenses had been met.

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## WHAT WAR HAS TAUGHT TO THE OPERATING MEN

### Lessons that Rising Costs Made It Necessary to Learn Should Not Be Forgotten Now that Peace Has Been Declared

During the last two years boiler rooms have been operating under difficult conditions. Equipment designed and selected for handling certain grades of fuel has been operated on fuels of very inferior quality because the better grades were taken for war purposes. Naturally difficulties have arisen in trying to use coals that would be entirely unmarketable in normal times. But out of these difficulties have come valuable lessons. Methods of handling boiler-room equipment have advanced. Boilers have been tested and stokers have been reconstructed that maximum efficiency might be obtained. Baffles have been redesigned to get a minimum of draft loss consistent with good distribution of gases. Arches have been raised and lengthened to give better combustion. Settings have been rebuilt to exclude air, and car loads of setting insulation have been used with wonderful results. Pipes, feed-water heaters, boiler drumheads, pumps and engine cylinders that were never lagged before have been covered. Boilers and stokers have been tested to find the highest point of efficiency. Boiler-room instruments, including draft gages, Orsat apparatus, pyrometers and $CO_2$ recorders, have been purchased. Soot blowers, tube cleaners, Venturi tubes,

water weighers and flow meters have been installed to get energy to the switchboard for the least expenditure of B.t.u.'s. More attention has been given to operating data. The old method of frequently blowing down boilers has been discarded in favor of a titration-test method which saves money by reducing the number of blow-downs to two or three a week. All of these things have brought out lessons that should not be wasted now that the war is over.

The foregoing is a summary of the general boiler-room situation to-day as it was given by Edward Marshall of Cincinnati to the station-operating committee of the Ohio Electric Light Association recently.

## FROM THE VAULT TO THE OUTDOOR INSTALLATION

### Simple Wooden Structure Eliminating Necessity of Housing Consumers' Transformers in Brick Walls Improves Rating of Apparatus

Although a company in the Central West formerly made it a general practice to construct brick vaults in which to place transformers for industrial consumers, the war led it to mount transformers on wooden structures where they would secure the utmost ventilation and hence carry the largest loads. Brick walls, while proving a good protection to the apparatus, usually do not allow the proper ventilation. Furthermore, consumers usually require that vaults for transformers used to serve them be built in some out-of-the-way place where the space taken could not be used for any other purpose. Thus the transformers were usually put in places where air was not likely to circulate.

The wooden structure consists of a four-pole or three-pole structure with the transformer placed about 12 ft. (3.6 m.) from the ground on a platform supported between the poles. The necessary disconnecting switches are placed on the poles carrying the terminals of the transmission lines. The expense in raising these transformers is not considered excessive by the engineers of this company; in fact, the amount is very little higher than that entailed in placing them in the vault.

## METER INACCURACY IS FOUND DUE TO REGULATOR

### Potential Side Connected Across Bus and Current Side in Load Circuit, Causing Phase Error and Voltage Difference

BY HALBERT R. THOMAS

Meter and Test Department, Southern California Edison Company

Meter trouble is not often traced to a regulator, but in one instance a rather baffling puzzle was solved when the regulator was found to be the cause of the irregularity. The meter in question was installed on a single-phase circuit supplying a constant-current transformer on street lights, and it was provided with current and potential transformers. It was tested soon after installation on its normal load and found to be several per cent in error, but was adjusted and left registering correctly. Subsequent tests, however, showed a wide range of error under different load conditions, the meter even running backward when the street-lighting transformer was short-circuited. The trouble was looked for both in the meter and its transformers, but all were found to be in good condition.

Finally the wiring was traced out, and it was found that the potential transformer had been connected across the circuit on the bus side of an induction-type regulator which served the distribution circuits, while the current transformer was connected in the street-lighting circuit on the load side of the regulator. The inaccuracy of the meter was therefore caused not only by the difference in voltage at these points, but also by the considerable phase angle between voltage and current caused by the operation of this type of regulator.

It is worthy of note that the error in the meter might not have been discovered (at least as long as it ran forward) if the standard used in testing had not been provided with its own transformers cut into the circuit independently. A "secondary" test, even to the extent of utilizing the meter potential in conjunction with a standard current transformer, would presumably have indicated that the meter was accurate, a condition far from being a fact.

## RULES GOVERNING OPERATION OF LIGHTNING ARRESTERS

### Michigan Company Repeats Instructions on Aluminum-Cell Lightning Arresters, Many of Its Former Operating Men Having Been in the Service

The inspection and charging of lightning arresters on high-tension transmission lines is one of the most important duties of the station operators. If these arresters are not in good condition, a total interruption to service may be the result. Because of the importance of the subject, and because new operators have been filling the places of those who went to the front, the Consumers' Power Company of Jackson, Mich., has been repeating detailed instructions regarding the care and operation of these arresters in its bulletin, the *Au Sable News*. The instructions follow in part:

Consider the arrester alive at all times. By daily inspection be sure the pipe framework and guard railing are thoroughly grounded. Before any repair work is done on the arresters, open the horn gaps wide and ground the tanks and all insulated parts before touching any parts of the arrester, except the horn-gap operating handle and the transfer-device hand wheel. The arresters must be charged at least once each twenty-four hours. If the temperature around the arrester is 100 deg. Fahr. or higher, charge arresters two or even three times each twenty-four hours. To charge: (1) Close horn gap quickly until all arcing has stopped. Hold gap closed for five seconds. (2) Open gaps quickly to wide-open positions. (3) Reverse transfer switch. (4) Close gaps again for five seconds. (5) Open gaps quickly to wide-open position. (6) Set transfer switch in normal position. (7) Set gaps in normal position. Make note in log book, also on station record sheet, each time the arresters are charged, and also note any unusual occurrences or conditions such as: (1) The arc on the horn refusing to break when gaps are set to operating position. (2) Oil thrown from tanks or rumbling noise in the tanks. (A slight sizzling noise is often noticed when charging; this not not objectionable.) (3) Any arcing around arrester except at the horn. (4) Excessive charging current as shown by heavy yellow flaring arc at the horns.

The importance of careful inspection of arresters and insulators is also insisted on.

# CENTRAL STATION SERVICE

## A Department Devoted to Commercial Policy and Management Topics, Including Applications of Electric Light, Power and Heat

### PARTIAL-PAYMENT PLAN BRINGS BIGGER BUSINESS

**Brooklyn Edison Company Sells Any Article Priced at More Than $6 on Deferred Payments if Purchaser So Wishes**

Attention was directed to the psychological value of the deferred-payment plan by T. I. Jones, general sales agent of the Edison Illuminating Company of Brooklyn, N. Y., in a paper on merchandising of appliances, read before the supply jobbers' recent Cleveland meeting. Mr. Jones said in part:

"A far greater volume of business may be done with the installment-payment method than if payment in full is adhered to. The lure of partial payments is not limited to people who cannot afford to pay in full. Many a washing machine is sold to a consumer who could afford to pay, but would not pay, in full at any one time the sum of $125 or more, but who is willing to buy a machine on an initial payment of $25 and the balance in monthly installments.

"It has been the practice of the Brooklyn Edison company to sell on partial payments if desired any article the sale price of which is over $6, adding a carrying charge to cover interest, bookkeeping and collecting."

### ALL CO-OPERATION MUST NOT COME FROM CENTRAL STATION

**Brooklyn Sales Manager Points Out Present Merchandising Position of Utilities and How They Came to Be There**

The dealer in electrical appliances other than the central station, it was suggested by T. I. Jones, general agent of the Brooklyn Edison company, at the recent Cleveland meeting of the Electrical Supply Jobbers' Association, should not develop an attitude of mind, as frequently happens, which leads him to see only one side, and that the temporary and immediate side, of the merchandising question.

"He should not expect all the 'coöperation' to come from the central sation," said Mr. Jones. "He must remember the expensive and laborious central-station pioneering that has helped so much to make possible the present volume of appliance business. He must remember that the central station is usually the largest merchandiser of electrical appliances in its community, frequently doing more business than all the other retailers combined, and is entitled to consideration from that standpoint. He must remember, what has already been set forth, the present importance of the appliance load to the central station in connection with residence revenues. He must remember the fact that the central station, by reason of its relation to the customer as a purveyor of electric energy, is frequently in the best strategic position to sell him electrical merchandise, but that every article sold broadens the field and opens new avenues to wiring jobs and future sales of electrical appliances.

"Recalling these facts, he must recognize, in friendly fairness, that many, if not most, of the central stations are handling their merchandising problems in a broad and coöperative spirit, as real leaders, and he must let his response, wherever deserved, be one of cordiality and coöperation, for mutual advantage."

### EFFECT OF DAYLIGHT SAVING AT CANTON, ILL.

**Opinion Is Expressed that While Some Coal Saving Was Made, It Was Not in Proportion to the Loss of Revenue**

"It is very difficult for us to find wherein there was any considerable saving effected by the daylight-saving campaign and the lightless nights." said E. H. Negley, secretary and manager of the Canton (Ill.) Gas & Electric Company. "As nearly as we are able to ascertain, our lighting revenue was reduced about 10 per cent during the period covered by the lightless nights and the change of time, but so far as concerns being able to trace the coal saving, this is a very hard thing to do. It is possible that some saving was effected, but it was not in proportion to the loss of revenue. While the station is in operation the discontinuance of a few lamps here and there is scarcely noticeable, and we believe 5 per cent saving in the coal would be a conservative figure.

"To obtain some idea as to how much coal this amounts to, it could only be figured on the basis of just what coal was actually used for the lighting business, and as nearly as we are able to ascertain the lighting business in our city is only about 20 per cent of our total output. Fgured on a saving of 5 per cent of this coal, we are able to account only for a saving of about 150 tons during the entire eight months in which the daylight-saving plan was effective."

### CHANGE IS ANTICIPATED IN FINANCING POLICY

**Some Prospective Customers Consider that the War Is Over and Utilities Ought No Longer to Ask Customers to Finance Extensions**

During the war, when capital was out of the reach of the average central station, prospective customers were asked by many companies to finance their own line extension and transformer installations. On account of the urgent demand for power and because in so many

instances the government recognized the fairness of the utility's request for assistance, this policy was successful.

Now that the war is virtually over, central stations are already being forced to consider going back to their old policy of completely financing their customers or adopting some new policy which will be a compromise between the two extremes. The necessity for making this change is becoming more apparent every day to central stations' commercial organizations, which are negotiating with prospective power customers. Frequently these purchasers show no hesitancy in telling power salesmen that it is time the central station again relieved its prospective customers of such additional financial strain.

There are some utility men who think that central stations will never go back to their pre-war financing policy. Some even have suggested that perhaps it would be good policy to require customers to own such utilization apparatus as transformers, meters, etc. On this point, however, a representative of a prominent central station which had experience with this plan several years ago and entirely discarded it has stated that that particular company will not again require customers to own transformers.

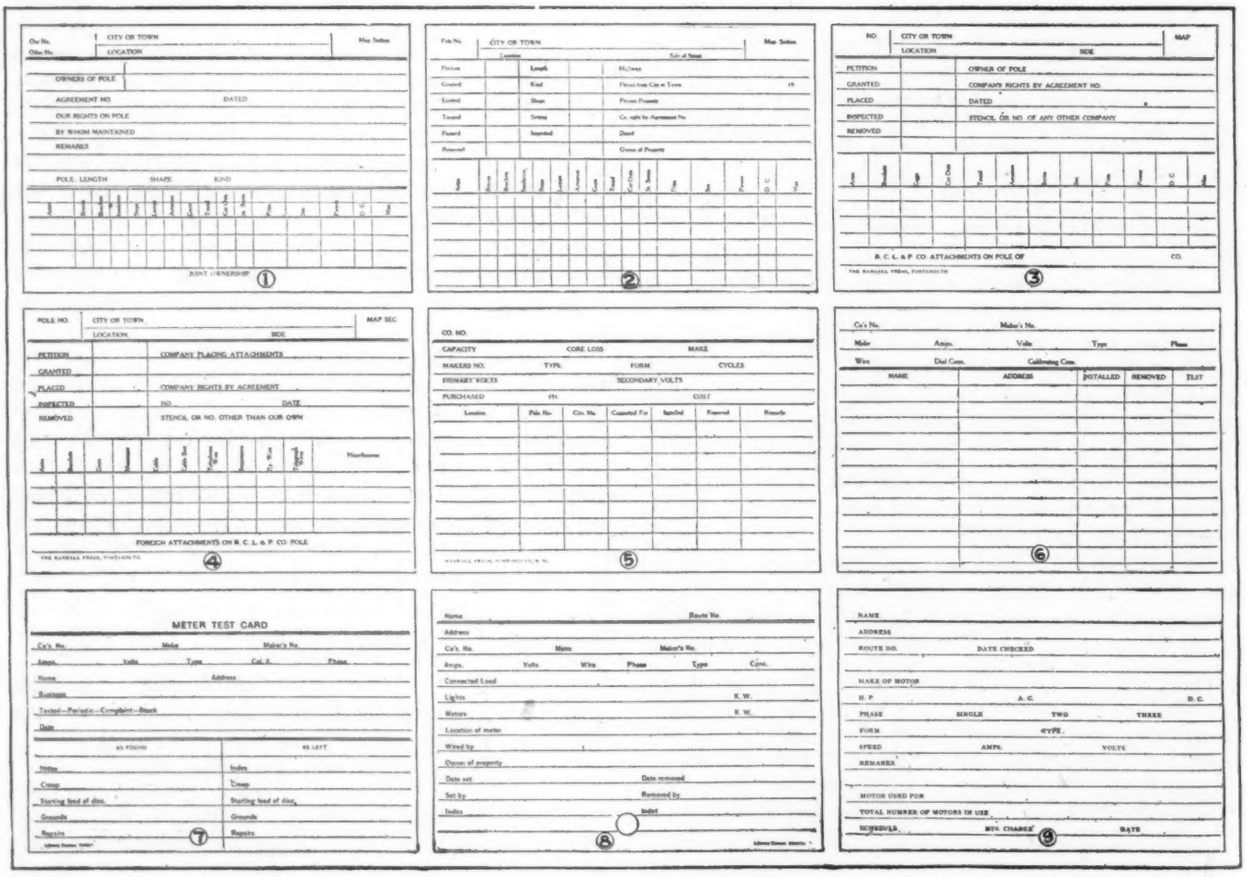
This same company will soon revise its financing policy, but will probably not go back to its pre-war policy of extending lines to every one who may ask for electric power.

Care will be used in analyzing the business of prospective customers to see if they have a good chance to succeed in their venture before money is spent in building for the purpose of serving them, with the possibility of finding the investment eventually useless.

## RECORDING SYSTEM FOR DISTRIBUTION EQUIPMENT

### Portsmouth (N. H.) Utility Makes Use of Cards to Show Not Only Equipment but Customer Data as Well

An unusually complete card record system for the distribution plant has recently been designed by the engineering department of the Rockingham County Light & Power Company, Portsmouth, N. H. The cards are about 4 in. by 6 in. in size and provide for recording full particulars in regard to pole data, transformer information, customers' connected loads, meter histories, meter tests, foreign attachments on company poles, company attachments on foreign poles, and motor listings. Some of these cards are reproduced on this page. The pole cards include one for joint ownership data, and this, with the separate cards for foreign attachment data and shared pole service, afford a means of conveniently filing material bearing upon intercompany relations and public aspects of line service which often is not readily available.




RECORDING SYSTEM FOR DISTRIBUTION EQUIPMENT

1. Joint-pole ownership card. 2. Company pole data. 3. Company attachments on foreign poles. 4. Foreign attachment card. 5. Transformer record card. 6. Motor record card. 7. Meter test card. 8. Customer's installation data card. 9. Motor record card

# TECHNICAL THEORY & PRACTICE

## Including a Digest of Important Articles Appearing in the Scientific and Engineering Press of the World

### Generators, Motors and Transformers

*Zigzag Leakage in Induction Motors.*—K. SACHS.—The zigzag leakage in induction-motor windings is calculated on the lines of a former article (*Abs.* 150, 1916) by considering the difference in flux that is produced by the stator and rotor ampere turns. These ampere turns are evaluated for various characteristic moments by replacing the polyphase windings by equivalent single-phase windings lying in slots that are unequally spaced so as to imitate the effect of the unequal currents flowing in the different phases of the windings at the moments considered.—*Science Abstracts, Section B,* April 30, 1918. (Abstracted from *Electrot. u. Maschinenbau,* Jan. 20, 1918.)

*Performance Diagram of Series Polyphase Collector-Ring Motors.*—A. TUMERELLE.—A short article explaining a diagram which, it is said, makes it easy to obtain characteristic curves for a series polyphase motor energized at constant current.—*Revue Générale de l' Electricité,* Nov. 2, 1918.

*Note on the Theory of Blondel Concerning the Armature Reaction of Alternators.*—A. LÉAUTÉ.—If an alternator is supposed to be operated at constant excitation and with variable current output but gives a constant terminal voltage, the extremity of the vector representing the (Joubert) internal emf. lies on a Pascal limaçon. A simple construction of this curve is given. It is shown that the power output of the machine decreases as the phase lag increases, the law being given in terms of three parameters.—*Science Abstracts, Section B,* April 30, 1918. (Abstracted from *Comptes Rendus,* Dec. 31, 1917.)

### Lamps and Lighting

*Use of Glow Lamps for Projection Apparatus.*—O. KRUH.—The author investigates, by the aid of formulas, the characteristics of glow-lamp filaments lending themselves to optical projection. A table of intrinsic brilliancies of the chief illuminants is given. Improvements have been made by mounting filaments as adjacent bars close together and increasing the diameter so as to use larger currents. The effect of altering the space between adjacent filaments is discussed. The chief difficulty in making lamps for very high currents has hitherto been the mounting of the leading-in wires. This, the author states, has been overcome, and lamps consuming up to 200 amp., giving 30,000 cp. to 40,000 cp. (Hefner) and working at 0.25 watt per candlepower (Helner), have been made. The candlepower attainable is limited only by the size of the bulb, but up to 100,000 cp. could be obtained if there were need. The effective intrinsic brilliancy of the source can also be increased by placing a mirror behind it, forming an image of the filaments in the spaces between the successive bars. In this way an intrinsic brilliancy of 70 cp. per millimeter, approaching that of the carbon arc, can be secured.—*Science Abstracts, Section B,* April 30, 1918. (Abstracted from *Elektrot. u. Maschinenbau,* Dec. 2, 1917.)

### Generation, Transmission and Distribution

*Electric Power Supply in British East Africa.*—A bill dealing in a comprehensive manner with electric power supply is now awaiting its final reading in the Legislative Council of the Protectorate of British East Africa. The measure is designed to foster and promote bulk supply systems and to insure standardization. In accordance with it public and local authorities must adopt the standards and specifications of the British Engineering Standards Association. Practically every form of energy which industrialists in the protectorate will require must be obtained from or by the conversion of electrical energy generated by water power, internal-combustion engines or oil-fired boilers. Consequently a demand for apparatus is developing, and it is suggested that British manufacturers should not neglect this opportunity. Inquiries from those interested should be addressed to the Government Electrical Engineer, Nairobi, British East Africa.—London *Engineer,* Oct. 18, 1918.

*Fusibility of Coal Ash and Determination of Softening Temperature.*—ARNO C. FIELDNER, ALBERT E. HALL and ALEXANDER L. FIELD.—This publication reviews the literature on the subject and gives in detail the effect of various oxidizing, reducing and neutral atmospheres, such as are found in various parts of the fuel bed, on the softening temperature of ash when molded in the form of Seger cones. As a result of this study a practical method of determining fusibility has been developed whereby the ash is caused to soften and form slags in which the iron exists in approximately the same state of oxidation as the iron in fuel-bed clinkers. Although it is believed that this method will indicate the probable clinkering characteristics of a coal better than any fusion tests heretofore described, the bureau does not recommend the general use of the method in coal specifications until it is justified by actual trial in furnace tests of different coals. As no fusibility test of a well-mixed sample of the average ash of a coal takes into account the physical distribution of the impurities in the coal as burned, much additional investigation is needed to establish the exact relation of these laboratory fusibility tests to clinker formation. Such investigations are being undertaken by the bureau at this time.—*Bulletin No. 129, Bureau of Mines.*

*Partial Transformation of Direct-Current Reducer Sets.*—C. L. BROWN.—A scheme is described for reducing direct-current voltages to lower values in which the motor and generator are connected in series across the line and the load is taken direct from the generator

terminals. This method is somewhat analogous to the well-known auto-transformation for alternating systems. The two advantages gained are higher combined efficiency and cheaper initial cost. Formulas are devised to show the size of machines required and thus the saving in initial cost. The importance of the greater overall efficiency is also demonstrated. It is pointed out that the advantages of this system are not so great when the voltage transformation ratio is high.—London *Electrical Review*, Nov. 8, 1918.

*Care in Operation of Small Turbines.*—J. A. MACMURCHY.—The small turbine is subject to greater neglect, because of its size, than large main units. In this article the author points out the parts of small turbines that should receive particular attention.—*Power*, Nov. 19, 1918.

*Principles of Waterwheel Design.*—DAVID R. SHEARER.—Some of the underlying principles in the design of waterwheels are given, referring particularly to the relation between the velocity of the water and the peripheral speed of the wheel.—*Power*, Nov. 19, 1918.

*Economic Design of High-Tension Transmission Lines.*— G. HORSTMANN—It is shown that a number of causes tend to fix the voltages used in high-tension transmission lines, and that economic considerations are assuming a greater importance in their design than questions of voltage drop. The operating costs of lines are analyzed and a distinction is drawn between the most economical section for a given load and the most economical load for a given section. The latter condition is carefully examined with reference to the 100,000-volt lines of the Murg transmission system. Voltage regulators enable the lines to be calculated according to economic considerations alone, and this enables higher current densities to be used than if the voltage drop were the important factor. As the size of transmission systems increases, the attendant difficulties increase to a greater extent, thus tending to set limits to the size of stations and the voltage transmission. It appears that the upper limit for distribution is 20,000 volts and for transmission 110,000 volts. The cost of three transmission lines and particulars of installation, insulators, masts, copper, etc., are set out in a number of tables. These lines are situated between Mannheim and Karlsruhe, Karlsruhe and Muggensturm, and Rotenfels and Forbach, and the costs per kilometer are worked out for each in the form $a + bs$, where $s$ is the section of the conductor. The cost of a transmission line is made up of the costs of corona and insulation losses and copper losses and interest on the capital invested. If those costs are plotted as functions of the current for various sections, a series of curves are obtained which show that there is a certain section for each value of the current that gives the smallest total cost. The calculations show that, although the most economical section is obtained with a constant current density for all loads, the most economical current density varies with the section of the wire, increasing with decreasing section.—*Science Abstracts, Section B*, September, 1918. (Abstracted from *Elektrot. Zeits.*, May 16, 1918.)

*Prevention of Line Disturbances by Suppression of Arcing Earths.*—W. PETERSON.—The production of arcing earths is caused by the piling up of unidirectional charges that are left on the conductors when the arc ceases temporarily. The process of the building up of such charges is examined, and it is shown that in alternating-current networks twice the line voltage may be reached in a defective conductor through the superposition of the phase voltage and the above-mentioned static electric charge. This causes the arc to be restarted, and a succession of such restartings of the arc may cause the voltage to rise to four times the original value. As the capacity of the circuit available when the arc breaks is only half as great as that of the circuit presented to the restarted arc, the frequency during the quenching of the arc is generally twice as great as that during the ignition of the arc. Theoretical wave shapes are drown and compared with actual oscillograms. Tables are given showing the voltages to be expected in single-phase and three-phase networks for different values of the capacities of the conductors between one another and to earth. The second portion of the article is concerned with methods of preventing the formation of excess voltages, and it is concluded that a very useful precaution is to earth the neutral point through a resistance of such a magnitude that the steady charge is reduced in half a period to such an extent that the sum of the phase voltage and the voltage due to the steady charge does not greatly exceed the normal phase voltage. It is remarkable to note how completely the arc collapses on the introduction of such a resistance and how the violent and noisy arc to earth degenerates into a silently burning arc that goes out very quickly. A similar result can be achieved with horn dischargers associated with suitable resistances, but this method is inferior to the former, as the protective device only comes into operation after the high voltage has been generated. Earthing through reactive coils is very effective. In contrast with the resistance method, several periods elapse before the voltage reaches its normal value, and after the arc is quenched the voltage rises so slowly that the best conditions are presented for the extinction of the arc, because the ionizing of the air vanishes before the voltage rises to such values as to maintain an arc. These theoretical conclusions are borne out by tests made of three interconnected 10-kw. networks fed by four separate generating stations. Earths were produced by damped string, but arcing earths were not produced when the system was suitably protected by reactive coils to earth. When using such coils it was found that exact adjustment of the constants of the coil is unimportant, and that good protection is afforded by coils varying somewhat in their dimensions.—*Science Abstracts, Section B*, September, 1918. (Abstracted from *Electrot. u. Maschinenbau*, June 30, 1918.)

## Traction

*Electrification of Main Lines in Austria.*—Utilization of water power for electrification of state railways was first studied in 1891, but the Ministry of Railways did not take up the whole matter systematically until 1905. The present notes outline the state program in the problem of utilizing all available water power in the Alpine district and in Dalmatia and electrifying as much as possible of 4400 km. of state and 1800 km. of private railways south of the Danube. A comprehensive study has been completed of all the geological, hydraulic and climatic factors involved, as well as of the

alternative schemes for utilizing and dividing the available water power. During this period the Railway Department has developed sixteen large water-power schemes of 70,000 minimum and 150,000 maximum hp. Opposition has been offered to speculative enterprises and to schemes involving the splitting up of valuable falls. In the original report of the commission appointed to consider the electrification of the state railways, particulars are given concerning electric railways in Germany, Switzerland, France, Italy, Russia, Sweden and Norway, particularly in respect of the state measures taken to secure technical and financial efficiency.—*Science Abstracts, Section B*, April 30, 1918. (Abstracted from *Elektrot. u. Maschinenbau*, Jan. 13, 1918.)

*Regeneration of Energy by Electric Railways.*—The author examines first the effect of regeneration upon the annual cost of energy. This varies according to whether the installation is steam or hydroelectric and according to the extent of traffic. It is more advantageous with steam. The author holds that electrical braking still presents difficulties with heavy trains and that more experience is necessary.—*Revue Générale de Electricité*, Sept. 14, 1918. (Abstracted from *Schweiz, Bauzeitung*, May 4, 1918.)

### Installations, Systems and Appliances

*Electrical Clock Installations.*—C. SYLVESTER.—Of the several systems of electrical clocks in use at the present time the "Synchronome" system in particular is briefly described in this article. It consist of a special form of automatic switch so combined with a pendulum that it operates exactly at each half minute. The action of the switch is arranged to impart an impulse to the pendulum so that it is kept swinging for the next thirty seconds. The object of the switch is to send impulses each half minute to a series of clocks placed in any desired position. Details of the system are described by the use of appropriate diagrams.—London *Electricity*, Oct. 11, 1918.

*Extracting Nitric Acid from the Air.*—M. Andriessen has, it is said, invented a new arc furnace which produces nitric acid in greater volume than has hitherto been possible. The arc is derived from alternating current at high tension. It crosses a current of air forced between the electrodes. The flame passes between the poles of an electromagnet which gives it a helical form, this permitting its inclosure in a very restricted space and an energetic cooling of the nitrous gas. With an oven of 35 kw. the inventor claims to have obtained 70 g. of acid as compared with 45 g. with a Birkeland oven of the same size. It is contended however, that this output has been equaled and even exceeded at Notodden, and that inventors should now seek above all to extract the acid from very much diluted nitrous gas in the most economic way possible.—*Revue Générale de l'Electricité*, Sept. 21, 1918. (Abstracted from *Elektrot. Zeits.*, May 30, 1918.)

*Metallic Tube for Joining Lengths of Bare Cable.*—The two ends of the cable to be joined are inserted in a flat metallic tube in which a series of notches are then made with a special tool. The contact is perfect, and it would require almost as much force to pull out the ends of the cable as to break it. The system is recommended because of its simplicity and because it can be employed in the coldest weather.—*Revue Générale de l'Electricité*, Sept. 7, 1918. (Abstracted from *Elektrot. Zeits.*, May 9, 1918.)

### Electrophysics and Magnetism

*Cables of Iron and Zinc Substitute for Copper.*—Extensive researches have been carried on by the Swedish government industrial commission to find a substitute which could be used instead of copper cables for transmission lines so as not to handicap the general electrification of the many industrial and rural districts of the country. The metals which are produced within the country in sufficient quantities for this purpose are iron and zinc. For cases where large amounts of power are to be transmitted and for long distances where iron conductors cannot be used it has been found that a combination of iron and zinc may be used. Zinc can naturally not be used alone on account of its mechanical properties without being armored with iron to increase its strength. The cables which were tested by the commission both mechanically and electrically were made in seven strands with the center wire of zinc and the outside wires alternately zinc and galvanized iron, so that the cable consisted of four parts of zinc and three of iron. This construction is intended for areas from 16 sq.mm. to 50 sq.mm., while for from 50 sq.mm. to 95 sq.mm. the cables are made with nineteen strands, ten of zinc and nine of iron. For still larger sizes thirty-seven strands are used, twenty-two of zinc and fifteen of iron. The specific resistance of these combination zinc-iron cables was found to be 0.0740 to 0.0780 at 50 cycles, 2000 deg. C. and 0.5 amp. per square millimeter, thus corresponding to a conductivity of 12.8 to 13.5. As the copper which can be obtained under present conditions for transmission-line purposes is very poor and in general has a conductivity not exceeding 55, it may be seen that a copper conductor can be replaced with a combination zinc-iron conductor having about four times the cross-section and about three and three-tenths times the weight.—Report of Swedish government industrial commission.

### Miscellaneous

*Last Words in Electrical Vehicle Development.*—A. JACKSON MARSHALL.—The speeds of electrical vehicles, both passenger and commercial types, are adequate to meet fully all rational requirements in large cities, ac cording to the author. As soon as financial conditions will permit an extensive electric taxicab service will be begun in New York and other cities. Electric taxicabs have been successful in Europe for some years. Tests are cited to show that electrically propelled vehicles will actually cover a route more quickly where a number of stops are required, in urban traffic, than horse-drawn or gas-propelled vehicles. It is pointed out that electric vehicles may be used for long-distance traveling, and attention is called to the popularity of electric vehicles in New Zealand. In discussing excessive speeds of ponderous vehicles, their destructiveness to road contruction is emphasized. A formula is suggested considering the case of a 20,000-lb. (9000-kg.) unit with a speed limited to ten miles per hour, showing that the "fee" or compensation for road wear would be $20, and where the speed obtainable is fifteen miles per hour the fee would be $45. Thus it would seem that high speed is particularly undesirable from the standpoint of road maintenance.—*Southwestern Electrician*, Oct. 31, 1918.

# Readers' Views and Comments

## Direct-Current Arc Welder

*To the Editor of* ELECTRICAL WORLD:

SIR: I have read with much interest the article on arc-welding characteristics written by J. F. Lincoln, and I agree with the conclusions which he arrived at in his analysis of the alternating-current welder. However, I wish to call attention to a statement made in the preliminary paragraph of the article regarding the direct-current machines.

In speaking of direct-current machines of the inherent regulating type, Mr. Lincoln states that it is impossible to get more than one arc off such a machine. However, I would call his attention to the fact that with the closed-circuit system which is covered by a series of patents issued to the writer as many as ten arcs may be connected to an inherently regulated machine, said arcs being connected in series.

ARC WELDING MACHINE COMPANY, INC.
O. A. Kenyon, chief engineer.
New York City.

## The Demand-Meter Situation

*To the Editor of* ELECTRICAL WORLD:

SIR: Referring to the article on "The Demand-Meter Situation" in the Nov. 30 issue of the ELECTRICAL WORLD, we have the following comment to make:

There is no question that the choice of demand-recording instruments is governed largely by the magnitude and character of the customer's load. The annual income from the smaller customers will not warrant the installation of high-grade graphic recording instruments, whereas in the case of the larger customers the amounts involved are such that the highest grade equipment obtainable should be installed.

Where loads are heavy and variable a continuous graphic record of the load as a rule furnishes the most satisfactory basis for demand charging. The continuous record simplifies greatly the settling of disputes, makes available to the customer the necessary information to enable him to control his demand, and also furnishes the operating department with valuable data regarding load conditions on the customer's premises.

The maintenance of demand-metering equipment requires taking care of both the metering system and the chart-driving mechanism. The metering systems employed in most modern meters have been thoroughly tried out by the manufacturer and are easily maintained. Judging from the variety of types of timing systems employed, it is apparent that there is still considerable difference of opinion as to the best timing system for this work.

The writer's experience indicates that the greatest reliability and lowest maintenance cost result from the use of extremely heavy clock parts, together with the highest practical torque. A clock designed along these lines and inclosed in a separate dust-tight case will give satisfactory service for a period of from one to two years without any cleaning or attention other than winding.

At this time the metering and recording of demand is a very important subject from the standpoint both of the central stations and the instrument manufacturers. Articles such as the one written by C. F. Mathes, constructively criticising the instruments available at this time, are very interesting to the manufacturers.

D. J. ANGUS,
Treasurer and chief engineer the Esterline Company.
Indianapolis, Ind.

## Effect of Transient Voltages on Dielectrics

*To the Editor of* ELECTRICAL WORLD:

SIR: Two gaps set for equal 60-cycle spark-over voltages may have entirely different lightning spark-over voltages. For instance, if a needle and a sphere gap are each set at 150 kv., 60 cycles (operating frequency), the transient spark-over voltage of the sphere will be 100 kv., while that of the needle may be 200 kv. or more. Obviously, the needle, or point, is not a good arrester gap. The sphere or sphere-horn arrester gap is now used. The effect of wave front can be nicely shown experimentally by connecting a sphere gap and a needle gap directly in parallel. If the sphere gap is set at 200 kv., 60 cycles, and the needle gap at 100 kv., 60 cycles, an impulse may be made to pass at will over one gap or the other by a change in the wave front. The reason why lightning spark-overs and break-downs often occur in such unexpected ways is thus readily explained.

Two insulators or bushings with equal 60-cycle spark-over voltages may have entirely different lightning spark-over voltages. It is important to know how to design them so that the transient spark-over voltage is high. It is also important to know how to arrange the insulation in apparatus to obtain the maximum lightning puncture voltage. Many other interesting effects can be obtained with the impulse generator, for instance: (a) Corona produced by voltages lasting only one micro-second can be distinctly seen. (b) With some of the very steep wave fronts a 25,000-volt "drop" has been obtained from a 3-in. (7.6-cm.) copper tube about a meter long.

The "impulse generator" for studying the effect of transient voltages on dielectrics was devised some time ago by the writer. By means of this generator impulse voltages of any given wave front, length of tail, etc., can be obtained. In tests recently made the rate of voltage application was, in some cases, 1000 kv. per micro-second. The impulse generator and the early work were described in a paper, "Effect of Transient Voltages on Dielectrics," presented before the American Institute of Electrical Engineers in September, 1915, and also in the *General Electric Review* under the head of "Lightning," June, 1916.

Pittsfield, Mass. F. W. PEEK, JR.

## The Nature of Induced Emf. Again

*To the Editor of* ELECTRICAL WORLD:

SIR: Among the aviation problems brought out by the war there was one on speed measurement of airplanes with respect to the fixed ground. It is simple enough to measure the speed of an airplane with respect to the ambient air by means of some wind-wheel device, but such an indication is not very accurate in determining the position of the airplane as long as one does not know the velocity or the direction of the wind in which the airplane is traveling. In night flying, in sea patrol or during a fog the aviator is entirely lost as to his position. But to determine away up in the clouds his speed with respect to terra firma one would have to have something there that is invariable with respect to the ground, and about the only thing of this kind seems to be the earth's magnetic field. Imagine a long horizontal wire stretched across the airplane; an electromotive force will be induced in this fire by the vertical component of the earth's magnetic field, and emf. is directly proportional to the velocity of the moving airplane. Consequently, the induced voltage is a simple measure of this velocity, assuming the field to be constant.

In spite of the apparent simplicity of such an arrangement it seems to be impossible to measure this emf. by any known means. The two leads from the ends of the wire to the galvanometer will be cut by the same magnetic field in the opposite direction, and the total voltage registered by the instrument will be zero. Placing these leads in an iron pipe so as to shield them from the magnetic field would not remedy the matter in the least. Our experience with electrical machinery shows that the same emf. is induced in conductors placed on a smooth armature as in those embedded in slots.

Here is then an interesting practical problem and also an extremely important theoretical proposition about measuring the induced emf. in a moving conductor when the measuring device itself is moving with the conductor. I recommend both aspects of this problem to your readers.

V. KARAPETOFF.
Cornell University, Ithaca, N. Y.

# NEWS OF THE INDUSTRY

## Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields

### SYMPATHETIC STRIKE AT GENERAL ELECTRIC WORKS

Action Follows Reduction of Forces Because of Canceled Orders—Attitude of Company Stated by President E. W. Rice, Jr.

A sympathetic strike began at most of the plants of the General Electric Company on Dec. 19. Some of the men who went out had returned on Dec. 24, but it was estimated on Tuesday of this week that 20,000 men were out, including 15,600 at Schenectady. At Erie, Pa., where the cause of the strike originated, it was stated that 800 out of 5200 men were out, 400 of the 1200 employees who went out originally having returned. None went out at Lynn.

The strike followed the action of the company in laying off 200 men at the Erie works, of whom ten were union members, as a result of the cancellation of orders following the signing of the armistice. The union demands the reinstatement of the men, and other matters have also been raised, such as the recognition of the union.

#### President Rice Makes Statement

Replying to a communication from John I. Wickham, secretary-treasurer Electrical Manufacturing Industry Labor Federation, E. W. Rice, Jr., president General Electric Company, says that the committee plan of employee representation adopted in Erie "is the same kind of a plan as that adopted in Pittsfield and in Lynn, pursuant to the award of the National War Labor Board, and there is no reason for the elimination of the plan at Erie, unless similar plans are also eliminated at Lynn and Pittsfield, where they have been established under governmental direction. The elimination of such plans the company would decline."

On the question of lay-off the answer of Mr. Rice is: "That the managers of the several plants are taking up with their employees' committees the question of so handling the work as to reduce to a minimum either inconvenience or hardship from loss of work resulting from the cancellation of orders due to the cessation of the war and the diminished volume of orders received. This is a problem which involves different conditions in the different plants and in the several departments of each plant, and it must be worked out with the management of each individual plant because no general rules can be made applicable to all."

Regarding the reëmployment of men in the service Mr. Rice wrote: "On Dec. 11, 1918, a letter was issued to all departments of the company stating that it was a matter of great pride to the company that 8000 of its employees had entered the military or naval service and that we would welcome them home with pleasure and reinstate them in our employ. Your attempt to create the impression that we are refusing reëmployment to our men who have been in the service is unworthy of you, and the statement is untrue."

#### Condition at Pittsfield Works

Substantially half the employees at Pittsfield remained loyal, and at the Lynn (Mass.) works of the company all the employees remained at work and were at their posts on Monday of this week. It was claimed by the Pittsfield employees that local grievances existed in addition to the Erie matter which were factors in the strike action. In a statement to the press, General Manager C. C. Chesney of the Pittsfield works discussed the situation as follows:

"Orders have fallen off at least 50 per cent at the Pittsfield plant during the past month, and in that time we have laid off about 1200 hands. It has been the policy of the Pittsfield management to allow the latest to go unless we are obliged to discharge certain men because of inefficiency. For the past day or two I have been working on a short-time schedule which will go into effect next Monday, and thereby we hope to keep all our present force employed. Because of the comparatively few orders we now have on hand here in Pittsfield, the works could be closed entirely until Jan. 1 and the company would suffer little, if any, inconvenience and loss.

"There is absolutely no truth in the charge made by the men that the management has shown discrimination. Only yesterday I issued a notice assuring reëmployment for men who gave up their positions to serve the country. We claim, furthermore, that the strike is in clear violation of our mutual agreement with the War Labor Board."

Mr. Chesney said that the records of the company's employment office show that eighty-six men who have been in the service have asked for their old positions. Eighty have been placed; two have been promised work to start Jan. 1 at their own request, and the four others have been offered jobs but have not accepted them. It was further stated at the plant that the shop committee on appeals, organized by the War Labor Board, informed General Superintendent A. F. Blaisdell that it had no complaint to make regarding conditions at the Pittsfield works. The strike was still in force on Monday.

#### Present Status of Orders

Some figures as to the present volume of business and orders of the General Electric Company have been made public in connection with the strike situation. The 1917 orders aggregated $247,000,000. Orders received during the seven weeks prior to Dec. 14 were at the rate of $157,000,000 a year. In the last two weeks of this period they were at the rate of $125,000,000.

## COPPER EXPORT PRICE IS FIXED AT 23 CENTS

### Newly Formed Association of Producers Announces Figure for Export Metal of 3 Cents per Pound Below War Price

The newly formed Copper Export Association has fixed a price of 23 cents per pound for copper for export. This is 3 cents per pound lower than the prevailing government figure, which is to be discontinued. Since the War Industries Board relinquished its control of prices the copper producers have not made any announcements as to price, but bids have been on the market at from 19 to 23 cents. While the new figure applies only to export business, it is taken as an indication of reduction in the domestic price.

## HYDRO RATES MUST CARRY COST OF AUXILIARY SUPPLY

### Massachusetts Commission So Decides in the Case of Turners Falls Company and the Town of Westfield

The rates established by the Turners Falls Power & Electric Company and the town of Westfield, Mass., in a five-year contract signed April 13, 1918, are declared reasonable in a decision of the Massachusetts Gas and Electric Light Commission issued recently. The town owns a municipal lighting plant which it has operated since 1899. Hitherto it has generated in its station the electricity distributed.

The Turners Falls company recently entered Westfield to supply energy to the Springfield street railway. The question of buying electricity from the company was then under debate, and in the franchise it was stipulated that the municipality should be free to buy and the company be required to sell to the town such energy as it might need at any time for distribution to its inhabitants or for municipal use.

The subsequent contract calls for the delivery to the town for five years of all the electricity required by it, with a maximum of 2000 kw. continuously available at the point of delivery and such additional amounts available as may be necessary upon twenty-four hours' notice to the company. The following rates were established: For the first 1,000,000 kw.-hr. delivered in any operating year, $0.012 per kilowatt-hour; for the next 1,000,000 kw.-hr., $0.011; for the next 1,000,000 kw.-hr., and for all energy in excess of 3,000,000 kw.-hr., $0.009.

A coal clause provides for an increase in price to be paid by the town equivalent to 1 mill per kilowatt-hour for each dollar in excess of $5 per gross ton for coal delivered at the company's Hampden steam plant in Chicopee, and a corresponding decrease of 1 mill per kilowatt-hour for each dollar of coal cost below $4. At present the company's coal cost is about $8 per gross ton, making the rates 3 mills higher than the foregoing, with a range of from $0.015 to $0.012.

In accordance with the contract, the town requested the commission to pass upon the fairness of the coal clause. After investigation, the commission said in part:

> In common with all hydroelectric companies, the Turners Falls company is obliged to supplement its water-generated by steam-generated power in order to provide reliable and continuous service, and it has recently put in operation a modern and well-equipped steam plant at Chicopee for this purpose. To what degree it will be called upon to supplement the [Connecticut] river's supply is a matter of almost pure speculation, subject as the problem is to the immutable laws of nature, but that year in and year out the plant will be called on to supply a substatial amount is certain. It is true that the cost of coal does not directly affect the cost of electricity generated by water, but it must be borne in mind that every unit of hydroelectric energy has to carry the cost of the auxiliary which takes the burden when the water power fails.
>
> In view then of all the circumstances affecting the parties to this agreement, the so-called excess-coal-cost charge provision of the contract may in general terms be regarded as reasonably applicable and workable as a fair measure of the increased cost due to coal in a modern and efficiently managed station such as this is. Taking into account then the life of the agreement, the board is of the opinion that the rates and excess-coal-cost charge are fair and do not require modification. The return of normal conditions and a longer experience with the bulk supply of electricity will test the soundness of this conclusion before the present agreement expires and enable the town to see what modification, if any, should be required upon its renewal. Meantime the citizens of the town may feel assured that in the mind of the board sound and good judgment has been exercised in securing for the town an abundant and reliable supply of electricity upon favorable terms.

## ABANDON CONSERVATION IN INCANDESCENT LAMPS

### With Change in Fuel Conditions It Is No Longer Necessary to Continue Voluntary Restrictions and Limitations

The lamp conservation program involving restrictions upon inefficient incandescent lamps has been abandoned. John W. Lieb, chairman of the lamp committee, has sent the following letter to manufacturers:

> The urgent necessity of fuel conservation having largely passed, particularly in connection with the supply of bituminous coal to central stations, it was thought by your committee that it would be no longer necessary to continue the voluntary restrictions and limitations placed upon the production and distribution of inefficient incandescent electric lamps in accordance with the program approved by the United States Fuel Administration.
>
> This question was taken up at a recent conference in Washington, and we now have official approval of this course as disclosed in the attached letter just forwarded to us by the Fuel Administration through our Washington office.
>
> It is, therefore, suggested that all voluntary restrictions and limitations assumed by manufacturers, central stations, supply dealers, jobbers, etc., be withdrawn, effective Jan. 1, 1919. This conforms also to action under similar circumstances on the part of the War Industries Board as indicated by the inclosed statement.
>
> In terminating our relations as a committee of representatives I desire to express my warm appreciation of the hearty coöperation that I have enjoyed from all parties interested in this important voluntary conservation program.

The letter addressed to Mr. Lieb by G. N. Allen, acting director of conservation of the United States Fuel Administration, says:

> Confirming our recent interview, we approve of the suggestion you made that under present conditions the incandescent lamp manufacturing program recently approved by this administration be abandoned.
>
> In this connection we wish you would thank the various manufacturers who entered into this voluntary agreement,

in behalf of the Fuel Administration, for their patriotic coöperation in endeavoring to assist the Fuel Administration in its efforts to conserve the coal so urgently needed for the war.

## ALL PRIORITIES ARE OFFICIALLY CANCELED

### Formal Announcement Made by Judge Parker and Mr. Baruch of the Passing of Priorities Rules and Pledges

Circular No. 60 of the Priorities Division of the War Industries Board, addressed to all concerned, says: "Effective Jan. 1, 1919, all the rules, regulations and directions of every nature whatsoever issued by the Priorities Division of the War Industries Board are hereby canceled, and all pledges heretofore made on the suggestion or request of the said Priorities Division are hereby revoked."

This is signed by Edwin B. Parker, Priorities Commissioner, and approved by Bernard M. Baruch, chairman War Industries Board. It is dated Dec. 20

## NEW INTERCONNECTION OF CALIFORNIA POWER

### Advantages Found by War Industries Board and Company Representatives in Further Connection of Pacific and Sierra Systems

Acting on the suggestion of Major George F. Sever, Pacific Coast representative of the Power Section of the War Industries Board, a committee of engineering representatives of three power companies centering at San Francisco recently held a series of meetings to consider additional interconnections between their transmission systems. At the conferences the Pacific Gas & Electric Company was represented by F. G. Baum and P. M. Downing, the Sierra & San Francisco Power Company by J. E. Woodbridge, and the Great Western Power Company by W. G. B. Euler.

In the discussions the three properties were considered as one system and a study was made of the possible advantages to the entire network to be expected from further interconnections. Between the Pacific and Great Western systems and between the Sierra and Great Western systems no further interconnections were justified, it was agreed. Between the Pacific and Sierra systems, however, another interconnection between the high-voltage network near the south end of San Francisco Bay was found desirable and was recommended.

The Port Marion substation of the Sierra company would ultimately be the better transmission center, it was agreed, for the various lines radiating from the south end of the bay. For the present, however, the best plan would be for the Pacific company temporarily to terminate its 100,000-volt line at Mission San José and step down to 50,000 volts at that point. Then a 100,000-volt branch about a mile long should be built from Mission San José to connect with the main line of the Sierra system. The Sierra company at this part of its system operates at about 105,000 volts, varying between 102,000 volts and 108,000 volts. It was the opinion of Pacific company representatives that its voltage could be brought within the same range, making unnecessary any voltage-varying devices especially for interconnection purposes.

The committee agreed that this interconnection would have "the following inherent advantages that will prove of value to both companies":

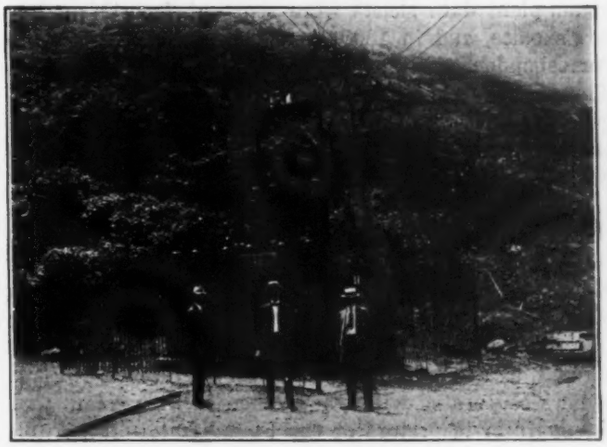
(1) A greater utilization of the hydroelectric energy that may be available at any time of the year, making it possible to combine the steam plant standby service better, at least during a certain part of daily and yearly operation.

(2) Improvement in the daily and seasonal load factor and power factor of the two systems as a whole, thus utilizing to better advantage the plant and transmission capacities of the systems.

(3) Adding an insurance feature to the service and thus reducing the capital charge of the individual companies for this purpose.

It was also thought that at some future time a consolidated substation at the south end of the bay would result in a reduction of capital and operation cost and in more effective operation.

## Power from This Station Produces 5000 Tons of Coal Daily



One of the big outstanding developments in recent power transmission has to do with electrification of coal mines. Particularly in the states of Indiana, Illinois, West Virginia, Pennsylvania and Kentucky has this movement been brisk. A sizable generating station and transmission systme was financed and built in one instance almost wholly on the strength of the mining load available. In all this work the fundamental feature was the outdoor substation. While nearly every company has been striving to arrive at its own standard outdoor design in this work, there has been no concerted effort to achieve a universally standard design. Perhaps this would be impossible in view of the widely varying conditions under which different groups of substations operate. A series of standard types might be the answer.

As typical of the work in this field the endeavors of the Kentucky Utilities Company may be mentioned. The photograph which is published here shows one of a group of substations that serve the Stonega Coke & Coal Company at Big Stone Gap, Va. It is rated at 600 kva., 33,000/2300 volts. A substantial steel tower supports the disconnecting switches, choke coils and lightning arresters. The transformers rest on a concrete foundation. All 2300-volt switches and measuring instruments are inclosed in a small metal house built at the base of the tower just behind the transformers. This substation is in a valley between two mine openings from which about 5000 tons of coal is produced daily.

# FUEL PROBLEMS BEFORE ENGINEERS IN BOSTON

## As Fuel Costs Are Still High and Promise to Continue So, the Incentive to Conservation Remains Strong

War-time fuel problems and how they were solved were discussed at a meeting of the Boston Section of the American Society of Mechanical Engineers on Dec. 19, the principal speakers being Prof. A. E. Norton of the Massachusetts Institute of Technology; David Moffat Myers, advisory engineer United States Fuel Administration, and Perry Barker, fuel engineer, Boston.

Professor Norton described the work of the engineers who advised New England Fuel Administrator James J. Storrow, and paid a high tribute to the particular work of Dr. Ira N. Hollis, president of the Worcester Polytechnic Institute; Charles T. Main, consulting engineer, Boston, and Thomas Hawley of the Hawley School of Engineering, Boston. The speaker said that the engineering advisory committee waked up the manufacturers and power-plant owners of New England to a realization of the critical problems of fuel supply and utilization, and spoke feelingly of the coöperative gains in plant efficiency thus secured. Twenty-nine hundred steam-plant data sheets were sent out from Mr. Storrow's office, and in 1300 cases the replies necessitated correspondence with the plant owners and operators. Through the shop committee system adopted at Worcester at least 100,000 tons of coal has been saved in the year, and this movement has spread to other important Massachusetts cities with good results.

The volunteer expert engineer-inspectors who visited the power plants and made immediate recommendations for economy accomplished much good, the speaker said. No time was lost in making recommendations through ordinary clerical channels, but the inspector visiting the plant in each case filed his report on the spot and carried away a carbon copy for reference. Plant owners coöperated willingly as soon as they found that the engineer-inspectors of the Fuel Administration understood their business.

In order that a permanent contact may be maintained between mill treasurers and their power plants, some sort of a committee organization should be formed before the Fuel Administration goes out of existence. In too many cases, Professor Norton said, the mill treasurer is uninterested in fuel economy simply because of the small percentage of total supply costs represented by the coal bills.

### CONSERVATION IDEA ACCEPTED BY PUBLIC

That the general public should have come to agree to the principles of fuel conservation is a triumph for the engineer's war service behind the lines, declared Mr. Myers. "It is not exaggerating," said he, "to state that the period of the war was materially shortened and that thousands of lives of our soldiers were saved by this great movement of constructive fuel conservation proposed, indorsed and largely executed by the engineers of this country. I therefore feel that I am here to-night primarily to celebrate with you this great victory of conservation."

The speaker said that a conservative estimate of the annual savings secured is 7,000,000 tons of coal in power plants, 1,000,000 tons on the railroads and 4,000,000 tons in such items as the introduction of skip-stops on electric railways, rearrangement of power plants to avoid duplication, the substitution of central power for that produced by isolated plants where such action was feasible, and the larger utilization of water power and savings in domestic consumption. Based on what has been accomplished, it should not be difficult to carry the annual savings up to 50,000,000 tons. At $5 per ton this would pay the interest on the country's war debt.

It was thought by many when the government took up the plan for power-plant inspection that many plant owners might resent this activity, but the patriotic spirit of all concerned led to excellent results. The disinterested manner in which the engineers of the administration and the various committees carried on their work resulted in their securing the full coöperation of the manufacturers and plant owners. Savings of from 5 to 30 per cent were realized in the fuel consumption of many plants.

### NO RELAXATION MUST BE ALLOWED

As fuel costs more than double the pre-war price and as little evidence of lower coal costs can be seen in the near future, the incentive to continue conservation work under peace conditions will be very strong. For the next few months it will be unsafe for managers to relax their efforts toward steam and fuel economy. The production of both anthracite and bituminous coal has fallen off rapidly during the past few weeks, and unless the production can be very considerably increased, stringent economies must be practiced in order to insure sufficient fuel to meet manufacturing demands.

Power-plant fuel economies have been based up to this time upon the idea of obtaining the highest possible efficiency from existing equipment, owing to the practical impossibility of securing new or improved equipment during the war. The chief factor has been the efficiency of the man behind the machine or on the factory committee, and up to the present time little or no official attention has been given to the efficiency of the apparatus and plant layout. This involves the matter of initial design and proper supervision of the changes contemplated in order that they may be made strictly in line with what will yield the highest efficiency in fuel utilization. Just before the armistice Mr. Myers proposed this question for discussion by the committee of consulting engineers of the Engineering Council, and it is hoped soon to secure a report from this committee.

The general idea is to formulate a so-called decalogue of power-plant design, treating only of fundamentals and not of specific designs. It is desirable to avoid ill-advised installations which waste fuel over long periods, and it is proposed to establish certain fundamentals of plant design which will guide plant owners and engineers in the selection of methods and equipment. The program of conservation cannot be considered comprehensive unless it treats both of operation and equipment. It is hoped to formulate the above principles before the close of the administration's work.

In closing, Mr. Myers spoke appreciatively of the

disinterested services of engineers in coöperating with the Fuel Administration's efforts and pointed out the duty laid upon engineers to see to it that conservation is continued. The public has great confidence in the engineering profession as a result in part of the war.

"We should look forward," said Mr. Myers, "to the future recovery and utilization of the valuable by-products of coal resulting from low-temperature distillation. No raw coal containing these by-products should be burned directly under boilers. The resulting carbonized coal should be the boiler fuel of the future. Water powers should be developed and utilized further, though, according to Dr. Steinmetz, even when these resources are utilized to the ultimate extent they can care for only a very small fraction of the power demands of the future and coal will always of necessity be our mainstay for heat and energy."

## UTILIZATION OF WAR-TIME COAL

It is estimated that New England steam coal consumers had in storage on Dec. 1, 1918, between four and five million tons of coal in excess of their supply on hand a year ago, according to a paper by Perry Barker, consulting fuel engineer, Boston. Mr. Barker pointed out that the source of coal supply for New England has not been materially different from former years but that the quality has been lower owing to the urgent need for increased production. The factors which affect the net utilization of coal for steam generation as expressed in the cost of evaporating a unit quantity of water are: (1) Cost per ton, including fixed price at the mine, freight and handling charges to the boiler furnace; (2) increased percentage of non-combustible; (3) increased percentage of volatile matter in fuel delivered to plants not having properly designed equipment for burning coal of such character; (4) decreased efficiency in burning coals not containing excessively high percentages of moisture, volatile matter or ash, but which have very low heating values due to "weathering" or heating in storage; (5) increased cost of evaporation due to poor efficiency and excessive labor and repair charges caused by using coal containing ash of a low fusing temperature.

The effect of increased percentages of ash is shown in Tables I, II and III. These figures represent from fifteen to twenty shipments of coal in each case and are typical fuels used by New England manufacturing companies. The average difference in heating value between the normal fuel and deliveries for the past year to a mill using low-volatile West Virginia coal was 3.6 per cent. This difference represents very nearly the actual decrease in evaporation per pound of coal, as the addition of this amount of impurities should have no material effect on the effciency with which the coal is burned. The comparatively small change in the quality of the fuel from this district is due to the fact that it is all subject to rigid inspection for naval and bunkering purposes.

The average of deliveries given in Tables II and III shows a much greater increase in non-combustible material. These impurities increase the cost of delivering a unit of combustible to the point of consumption, affect the distribution of air in burning the coal, cause excessive loss of combustible in cleaning the fires and entail extra labor charge for handling the ashes. It has been estimated that the average increase in impurities in fuel delivered is as high as 5 per cent, which would represent 1,250,000 tons of additional non-combustible transported with the 25,000,000 tons of coal supplied to New England this year. In one plant burning 10,000 tons of coal a year the cost due to handling ashes alone was increased to more than $2.50 per ton, representing an additional charge of $3,800 for the year.

Table IV shows the results of tests of three deliveries to plants normally using fuel of the quality given in column 1. The coal in column 2 was used in a hand-fired plant having return-tubular boilers with low settings. The firemen reported that the coal was "flashy" and made steam quickly, but with a firing interval of twenty to thirty minutes a large loss due to incomplete combustion resulted.

TABLE I—WEST VIRGINIA LOW-VOLATILE COAL

| | Normal | Average, 1918 | High Ash, 1918 |
|---|---|---|---|
| Moisture, per cent | 2.50 | 3.11 | 2.48 |
| Volatile matter, per cent | 17.50 | 17.91 | 18.42 |
| Fixed carbon, per cent | 74.00 | 70.83 | 68.98 |
| Ash, per cent | 6.00 | 8.15 | 10.12 |
| Sulphur, per cent | 0.65 | 0.63 | 0.73 |
| B.t.u. per pound | 14,410 | 13,886 | 13,656 |

TABLE II—PENNSYLVANIA LOW-VOLATILE COAL

| | Normal | Average, 1918 | High Ash, 1918 |
|---|---|---|---|
| Moisture, per cent | 2.50 | 4.74 | 6.82 |
| Volatile matter, per cent | 18.50 | 26.09 | 26.00 |
| Fixed carbon, per cent | 71.50 | 57.19 | 44.67 |
| Ash, per cent | 7.50 | 11.98 | 22.51 |
| Sulphur, per cent | 1.40 | 1.12 | 1.47 |
| B.t.u. per pound | 14,125 | 12,554 | 10,047 |

TABLE III—PENNSYLVANIA STEAM SIZES OF ANTHRACITE

| | Normal | Average, 1918 | High Ash 1918 |
|---|---|---|---|
| Moisture, per cent | 4.50 | 6.92 | 6.77 |
| Volatile matter, per cent | 5.00 | 5.74 | 4.40 |
| Fixed carbon, per cent | 74.50 | 67.12 | 57.50 |
| Ash, per cent | 16.00 | 20.22 | 31.33 |
| Sulphur, per cent | 0.80 | 0.52 | 0.42 |
| B.t.u. per pound | 11,775 | 10,440 | 8,635 |

TABLE IV—TYPICAL CHANGES IN CHARACTER OF COAL FOR NEW ENGLAND STEAM PLANTS

| | Normal Coal | War-Time Fuel | | Supply |
|---|---|---|---|---|
| | 1 | 2 | 3 | 4 |
| Moisture, per cent | 2.50 | 4.28 | 16.87 | 0.62 |
| Volatile matter, per cent | 18.50 | 34.12 | 28.00 | 19.36 |
| Fixed carbon, per cent | 71.50 | 47.16 | 44.50 | 67.90 |
| Ash, per cent | 7.50 | 14.44 | 10.63 | 12.12 |
| Sulphur, per cent | 1.20 | 1.94 | 0.46 | 3.61 |
| B.t.u. per pound | 14,150 | 12,074 | 8,990 | 13,543 |
| Fusing temperature | 2,550 deg. Fahr. | | 2,120 deg. Fahr. | |

The figures in column 3 of Table IV illustrate a type of fuel which has been delivered to New England during the past year. This "outcrop" coal is loaded from seams which have been exposed and a part of the combustible volatile matter lost. Coal of this character will not coke in the boiler furnaces, thus causing uneven distribution of air and excessive losses of combustible to the ash pits. The shipment of "outcrop" coal has been stopped by the Fuel Administration, and to date about 200 mines responsible for such fuel have been closed. The coal shown in column 4 of Table IV is of the most troublesome character owing to the low fusing temperature of the ash. It will be noted that this figure is 430 deg. Fahr. below the coal used prior to 1918. The low-fusing temperature caused excessive clinkering, particularly at the high rates of combustion necessitated by the overloaded condition of the boilers.

## OPPORTUNITY FOR INDUSTRY IN THE GOVERNMENT PROGRAM

### General War Service Committee of the Electrical Manufacturing Industry Offers Service of Its Organization to the Government

Bulletin No. 12 of the General War Service Committee of the Electrical Manufacturing Industry, dealing with reconstruction matters, says in part:

From a practical standpoint war is now over, but cooperation between manufacturers and government, with the full potentiality of the emergency through which we have just passed, is ushering in an era of tremendous possibilities.

At the Atlantic City conference of war service committees it was emphasized by many speakers that the best policy of this country in the matter of raw materials would be to treat even the Central Powers generously so that they may be enabled to pay the debts imposed by the war. It was clearly indicated that the supply of raw materials is insufficient to fill reconstruction needs essential to the economic development of the countries engaged in the war.

To provide the opportunity for industry to mobilize and coöperate in the solution of reconstruction problems in the same manner it did for "winning the war," the Secretary of Commerce has invited fourteen of the leading men in the War Industries Board to serve as his advisers for the period of reconstruction. Industry is thus given an opportunity to continue, through its war service committees, the coöperative effort which has proved so effective in war by establishing a direct contact through the Department of Commerce between the government and industry whereby the needs of each may speedily receive due consideration and appropriate action. Accordingly your General War Service Committee has in your behalf accepted the invitation and proffered to the government the services of our war service organization.

In order that we can discuss the means which will best fulfill our obligation to render full assistance to the government in this difficult situation, a general meeting will be called at the earliest possible date. Meanwhile hold fast—suffer no change of policy without consulting with your group committee.

## THE HARVARD SCHOOL OF ENGINEERING ORGANIZED

### Plan of Reorganization to Accord with Ruling of Massachusetts Supreme Court Regarding Use of Gordon McKay Funds

The Harvard School of Engineering, reorganized in accordance with a ruling of the Massachusetts Supreme Court regarding the use of funds willed by the late Gordon McKay, will be opened for instruction on Jan. 2, 1919. Courses will be continued during the summer in order to enable students to complete a full year's work before the opening of the academic year in September.

The school was first established in 1914, when Harvard University and the Massachusetts Institute of Technology entered into an agreement to coöperate in courses on engineering and mining. By this plan some of the funds left under the McKay will were to be used. The court held that the agreement could not be carried out under its terms, by which Harvard was made the beneficiary. Under the new plans which have been approved by the trustees of the McKay estate and the governing board of Harvard, the school will be maintained as a separate institution with the instruction wholly in charge of a Harvard faculty and will lead after four years of study to the degree of bachelor of science.

The work will be carried on in the classrooms and laboratories of the university, with the exception that arrangements may be made from time to time to utilize the facilities of other institutions, especially in the advanced technical courses, when the needs, financial resources and best interests of the school so require. This latter provision is subject to the approval of the court. Courses will be given in mechanical, civil, sanitary and electrical engineering, mining, metallurgy and industrial chemistry. The requirements for admission are to be the same as those for Harvard College. The degree of master of science, or an equivalent degree, is to be awarded upon the successful completion of at least one additional year of study. For the doctor's degree the requirements are to be similar to those in the Harvard Graduate School of Arts and Sciences.

Among the faculty are the following professors well known in the electrical world: Arthur E. Kennelly, professor of electrical engineering; Harry E. Clifford, Gordon McKay professor of electrical engineering; Comfort A. Adams, Abbott and James Lawrence professor of electrical engineering; Lionel S. Marks, professor of mechanical engineering; George W. Pierce, professor of physics and director of the Cruft memorial laboratory.

## THE CENSUS OF THE 1917 ELECTRICAL INDUSTRIES

### The 1917 Information as to Central Stations Is Now Being Compiled by the Census Bureau, and Early Returns Are Promised

S. L. Rogers, Director of the Census, in his annual report to the Secretary of Commerce, made public in Washington last week, announces that his bureau will soon be able to present to the public the result of the census of electrical industries which was taken during 1917.

The census, which was begun in April in Omaha, Neb., and which, in accordance with the general practice of the Census Bureau, was collected so far as possible through correspondence, will present information as to the number of establishments engaged in electrical industry, character of ownership, traffic, equipment, expenses, employees, salaries and wages, finances, etc. The compilation of this information is now under way.

In his annual report Director Rogers says:

This census, which, under the act creating the permanent Census Bureau, has been taken quinquennially since 1902, covers central electric light and power stations, street and electric railways, telephones and telegraphs, and municipal electric fire-alarm and police-patrol signaling systems. The current inquiry is being made as of Dec. 31, 1917.

By reference to the various records available, supplemented by correspondence with some 14,000 postmasters throughout the country, with state telephone associations and with public service commissions, a card index of establishments engaged in electrical industries was prepared. In formulating the schedules used, criticisms and suggestions were requested and obtained from the Interstate Commerce Commission, the American Telephone & Telegraph Company, the independent telephone companies, the American Electric Railway Association, the American Railway Accountants' Association and the National Electric Light Association, and a number of conferences were held with representatives of these organizations. All the organizations named have given their hearty coöperation and have rendered valuable assistance to the bureau in the revision of the schedules and the preparation of the reports.

# INVESTIGATION OF THE MILWAUKEE PROPERTIES

## Report of Hagenah & Erickson Follows Request of Employees for Higher Wages, Which Was Rejected Because of Insufficient Revenue

A report by Hagenah & Erickson of Chicago on an examination of the books and records of the Milwaukee Electric Railway & Light Company and the Milwaukee Light, Heat & Traction Company has been made public. The investigation grew out of a request on the part of the employees of the companies for increased wages, which the companies felt that they were unable to grant owing to insufficient net revenue. Permission was given to the Employees' Mutual Benefit Association, representing the employees, to satisfy itself from the books of the companies as to their ability or inability to grant the increases requested.

An auditing committee of the association, composed of G. W. Kalweit, William E. Gundlach and A. J. Killa, in recommending to the board of directors that the association accept the Hagenah & Erickson report, gives a synopsis of that document. The committee says in part:

The report points out that the value fixed by the Railroad Commission is based on average cost of labor and material for a period of years prior to 1914, that since then copper wire has increased 80 per cent, cable 50 per cent, pig iron 100 per cent, lumber 20 to 40 per cent, granite paving blocks 30 per cent, cedar poles 40 per cent, rails 40 per cent and ties 75 per cent. It points out that present-day prices ought not to be used but that higher costs would have to be applied in valuing the property in 1918. It points out that a trained and skillful organization was acknowledged as a property value in the Wisconsin Telephone Company case but was given no value in the case of the company. Except for these, it does not believe the commission's value is subject to criticism.

We understand that Hagenah & Erickson have made a great many appraisals for commissions and cities, and it is probably true that the Railroad Commission's value is not over-liberal.

The report points out that the commission allowed 3 per cent as a proper provision for depreciation in its street-railway fare case decision of June 1, 1918, and after a number of proving calculations accepts this as fair for the entire property. It points out that the method used by the commission is not open to serious criticism.

What is a fair return in this kind of business? Have the companies earned more than a fair return in the past?

The report points out that a fair return is indicated to be ordinarily not less than 7.5 per cent of the fair value of the properties. Courts and commissions have generally held that a return of from 7.5 to 8 per cent was not only reasonable but necessary to attract capital. At present a return of 8 per cent is probably too low. In the past ten years the company's return has not been unreasonable. The estimated return for the entire company in 1918 is 4.8 per cent. The railway system alone is 3.84 per cent; the electric and heating system is just over 6 per cent. These returns are indicated as being too low for the best interests of the service, which condition has already been recognized in part by the Railroad Commission of Wisconsin. We have no suggestion to make on the rate of return that is fair except to point out that savings and loan stock secured and protected by rigid state laws earns in excess of 7 per cent.

The report points out that with the adoption of the standard of wages recognized by the War Labor Board operating expenses would be increased over $900,000 per year, made up as follows: Railway employees and shop men, $640,000; electric and heat department employees, $265,000; total, $905,000. It points out that this increase in wages could not be made with present rates and could only be met when granted an increase in rates sufficient to make a wage adjustment possible and provide what is considered a fair return on the investment.

Since the report was written the Railroad Commission has increased electric rates. In addition to providing for increased cost of coal, materials and taxes, the commission has allowed 1.9 mills for wages in the electric and heating departments. This amounts to $350,000 per year. This increase in wages was made on the date the commission's order was delivered. The electric order made no provision for increased wages for street-railway employees. The $640,000 per year needed to bring railway employees' wage scales up to War Labor Board standards can be provided only through increased railway fares.

Our examination of the report and our familiarity with the accounting systems of the companies convinces us that the work of Hagenah & Erickson has been well done. The report appears to fully cover the scope of the work required by our association and to answer completely the several questions raised. We accordingly recommend the acceptance of the report.

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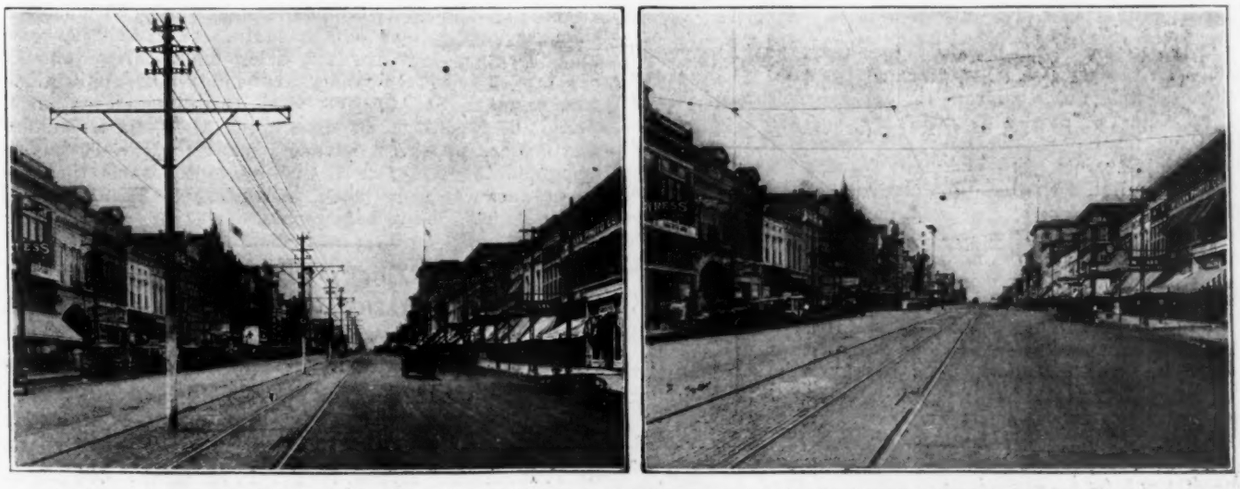
## A Business Street Before and After Rehabilitation

Garrison Avenue, in Fort Smith, Ark., was until recently a jungle of public utility poles and overhead construction. It is now a broad, clean thoroughfare from which the majority of the supporting structures have been removed. The photographs which are published here show Garrison Avenue before and after the Fort Smith Light & Traction Company had undertaken the work of rehabilitation.



A FORT SMITH (ARK.) BUSINESS STREET A FEW MONTHS AGO AND AT THE PRESENT TIME

## CAPITAL ISSUES COMMITTEE WILL SUSPEND ACTIVITIES

### Imperative that Capital Should Be Saved and Not Wasted—Law Sought to Prevent Sale of Fraudulent Securities

The Capital Issues Committee of the War Finance Corporation will suspend active operations on Dec. 31. Chairman Charles S. Hamlin of the committee announces that it will not be dissolved but will remain inactive unless it is found that the sale of new securities competes unduly with government financing or for other reasons it may become desirable for the committee to resume its work pending its dissolution by the President or by operation of law.

A statement by Mr. Hamlin says:

Although the war emergency which gave rise to the creation of the committee has passed, it is nevertheless imperative that capital should be saved and not wasted, and the removal of the restraining influence exerted by the committee during its existence should not be construed as approval of the financing of unnecessary public projects or private enterprises of doubtful merit. On the contrary, the financial needs of the government and the large capital requirements of the railroads and for the readjustment of American industries to a peace basis compel strict economy in the use of new capital.

While legitimate business may safely be left to work out its own problems, the Capital Issues Committee feels that it would be unfaithful to its responsibility if it failed to warn the public respecting the enormous losses sustained by the nation through the sale of worthless and fraudulent securities. In the opinion of the committee the sale of such securities should be restrained in times of peace as well as in war, and it strongly urges that Congress establish adequate machinery to put a stop to this traffic.

The extent of the menace, due to the issue of such securities, to the holders of government bonds is revealed by the fact that schools are being established in some parts of the country to drill salesmen in the art of persuading investors to subscribe for unmeritorious or worthless securities. This can only be prevented by legislation vesting in some duly constituted public agency full power to restrain the offering of fraudulent or worthless securities.

The Capital Issues Committee warns the public and earnestly directs the attention of Congress to the problem. It is the intention of the committee to make a supplementary report to Congress recommending a law to prevent these existing abuses and such impositions upon the investing public. The committee will maintain its offices in Washington until further notice.

Secretary of the Treasury Glass also issued a statement saying in part:

The decision of the Capital Issues Committee to suspend its activities on Dec. 31 should not be interpreted by the business public as a warrant for any expenditure of capital for needless or unwise purposes, whether public or private in their nature. Should it become apparent that voluntary restraints are not being exercised so as to prevent the misuse of capital, I shall request the committee to resume its control.

My chief misgiving in accepting the action of the committee arises out of the need the committee has frequently expressed, and the importance of which has become increasingly obvious, of protecting the public investor against the flood of worthless or doubtful securities which threaten the market when the restrictions are removed.

I intend to ask Congress immediately for legislation that will check the traffic in worthless securities while imposing no undue restrictions upon the financing of legitimate business, and shall urge that it be made effective before the close of the present session. Meantime, it may become necessary before such legislation is passed to reassemble the committee for the purpose of resuming its functions.

## ADVANCES TO PUBLIC UTILITIES BY WAR FINANCE CORPORATION

### Relief to the Amount of Forty-two Million Dollars Authorized to Sixteen Companies, Part of Which Has Been Repaid

According to the annual report of the War Finance Corporation, when that body was organized and announced itself ready for business late in May it found a large number of applications pressing for action, most of which were from corporations operating public utilities. The managing director of the corporation comments on this situation as follows:

The impression seemed to prevail in the minds of some that the act was designed particularly to finance the maturing obligations of these corporations, and the directors found it necessary to make a public statement calling attention to the fact that the resources of the corporation could not be loaned directly to essential industries unless in exceptional cases where relief could not be had through the usual banking channels, and that in every instance the directors were charged with the duty of requiring adequate security.

The directors adopted a policy in those cases where it appeared necessary to make direct advances to public utility companies, under the provisions of Section 9, of enlisting the coöperation of holders of maturing obligations, and this policy has proved very successful. In many cases adequate relief was provided by making advances of less than one-third of the amounts originally asked for, and in other instances it developed that the moral effect of a commitment by the corporation was such that the whole amount desired was obtained through the investment market without the necessity of calling upon the corporation to take any part of the amount agreed upon.

In making advances to public utilities the directors of the corporation undertook to satisfy themselves not only that the facilities afforded by these companies were necessary or contributory to the operation of enterprises directly engaged in the manufacture or transportation of war essentials, either by furnishing power or by affording means of transportation for labor employed at the war industries, but also that action by the corporation was necessary to avert a general financial condition which would have affected unfavorably government borrowings.

While the banks as a rule have shown a liberal attitude toward public utilities by renewing in whole or in part obligations already held by them, their policy has been to decline to act as intermediaries between the utility companies and the War Finance Corporation, as contemplated in Section 7 of the act, their preference being for commercial paper of short maturity.

The corporation received ninety-nine applications for advances to public utility companies, aggregating $175 595,113. Of these applications ten, amounting to $2,522,642, were, under Section 7 of the act, being made through banks, bankers or trust companies, and eighty-nine applications, amounting to $173,072,471, were for direct loans under Section 9 of the act. Of these applications, six under Section 7 were approved, advances made to Nov. 30 having amounted to $1,942,642.49, and up to the same time ten direct advances were made, amounting to $38,916,300, of which $11,967,500 has been repaid.

## Books Received

ELEMENTARY MATHEMATICAL ANALYSIS. Textbook for First Year College Students. By Charles S. Slichter. New York: McGraw-Hill Book Company, Inc. 498 pages, 186 illustrations. Price, $2.50.

THE GASOLINE AUTOMOBILE—ELECTRICAL EQUIPMENT; WITH NOTES ON ITS MAINTENANCE, CARE AND REPAIR. By P. M. Heldt. Nyack, N. Y.: P. M. Heldt. 406 pages, 317 illustrations.

## *Associations and Societies*

A complete Directory of Electrical Associations is printed in the first issue of each month.

**American Museum of Safety.**—It has been decided to change the name of the American Museum of Safety, beginning Dec. 31, to be "Safety Institute of America."

**A. I. E. E., Schenectady Section.**—"Steam Road Electrification" was the subject of an address by A. H. Armstrong of the General Electric Company at the monthly meeting of the Schenectady Section, A. I. E. E., held Dec. 20.

**Electrical League of Cleveland.**—At the regular Thursday noon meeting, Dec. 19, of the Electrical League of Cleveland Walter C. White, vice-president of the White Company, addressed the meeting on the subject "Auto Trucks in Army Service."

**Los Angeles Jovian Electric League.**—The regular weekly meeting of this league was held Dec. 11. Leslie Henry, special representative of the Federal Reserve Bank, was speaker of the day. D. C. Pence of the Illinois Electric Company acted as chairman.

**I. E. S., Philadelphia Section.**—On Dec. 20 T. C. Mahady, fuel engineer for Philadelphia of the federal Fuel Administration, addressed the Philadelphia Section of the Illuminating Engineering Society on the subject "Fuel Conservation as Affected by Lighting Curtailment."

**N. E. L. A., Philadelphia Section.**—The engineering department branch of the Philadelphia Section, National Electric Light Association, held a meeting Dec. 17 at which J. M. Cope, field engineer of the Chester generating station, spoke on "Construction of the Chester Generating Station."

**Ohio Electric Light Association.**—At a recent meeting of the Ohio Electric Light Association a general meter conference was held. J. T. Kermode presented a paper entitled "Conservation in the Meter Department." A round-table discussion of problems of interest to meter men was devoted principally to different types of demand meters. C. P. Garman of Dayton is chairman of the meter committee.

**Massachusetts State Association of Electrical Contractors and Dealers.**—The meeting on Dec. 19 of the Massachusetts State Association of Electrical Contractors and Dealers, held in Boston, was devoted to a discussion of the "open price" plan of coöperation. This new form of coöperative organization is of great interest at the present time, when the electrical contracting business faces the uncertainty involved in getting back to a normal basis.

**A. I. I. and S. E. E., Cleveland Section.**—On Dec. 14 the Cleveland Section of the American Institute of Iron and Steel Electrical Engineers devoted an entire evening to discussion of storage-battery industrial trucks, tractors, trailers and other equipment for operation with power units. Representatives of equipment manufacturers were the principal speakers. Among the manufacturers who presented information were the Mercury Manufacturing Company, the Lakewood Engineering Company, the Leeson Lift Truck Company, the Lansing Company, the Edison Storage Battery Company, the Electric Storage Battery Company and the Electric Products Company. The suggestion was made during the course of the discussion that a committee of the A. I. I. and S. E. E. should be designated to meet with the manufacturers to work out standard specifications for suitable industrial storage-battery haulage equipment for iron and steel mills.

## *Commission Rulings*

Important decisions of various state bodies involving or affecting electric light and power utilities.

**Value of Abandoned Plant.**—In allowing increased rates for the Aguilar Light & Power Company, the Colorado Public Utilities Commission discussed the value of "abandoned steam plant" as follows: "At the hearings in this case the respondent contended that full allowance should be made by the commission for its abandoned steam plant, which was appraised by the engineering staff at $5,000. The commission is of the opinion that some consideration is to be given to this claim, but that it cannot be allowed in full. This plant was installed in good faith and was abandoned much before the end of its useful life for the purpose of improving the service and reducing the operating expenses. The electric generators have been disposed of, so that as the plant now stands it is of no value to the property even for standby service. The boilers and engines should, in the opinion of the commission, also be disposed of, especially at this time when they are much in demand and will command a fair price. It cannot be assumed, as urged by the respondent, that the existence of this plant is of value for the purpose of securing a reasonable rate for energy at wholesale from the Trinidad Electric Transmission, Railway & Gas Company, since that company is entirely under the jurisdiction of this commission and the present rate cannot be increased without the consent of the respondent unless a proper showing that such increase is necessary be made to the commission."

**Boston Sliding Scale in War-Time Costs.**—In raising the standard rate of the Boston Consolidated Gas Company from 90 cents to $1 per 1000 cu.ft. the Massachusetts Board of Gas and Electric Light Commissioners says in part: "The language of the act itself, as well as its history and the English precedent upon which it was modeled, makes it evident that the Legislature fixed the standard price at a figure sufficient in its opinion to permit the company to earn the standard dividend. A price so fixed necessarily reflected the then cost of producing and distributing gas, based on the experience not only of the Boston company but of the industry as a whole. Obviously if such cost were to be subsequently affected by improvements in the art, or other circumstances not attributable to the skill and efficiency of the management, or by decreased or increased burdens beyond its control, the standard price would no longer bear the same relation to the standard dividend as at the outset, and the stockholders might have an undue reward, notwithstanding management of a very moderate capacity, on the one hand, or on the other might be unable to earn the stipulated return, without fault on the part of the management and in spite of the utmost skill and efficiency. . . . The unprecedented prices which the essential factors in gas making—coal, oil and labor—are now commanding are too well known to require discussion. The causes are beyond the control of the companies. The resulting increase in the cost of making and distributing gas under conditions similar to those surrounding the Boston company has approximated 30 cents as compared with the cost at the time when the standard price was adopted and during the intervening pre-war period. . . . The sliding-scale system of regulation makes reduction in price to the consumer depend solely upon the desire of the stockholders for greater dividends. It rests upon the belief that this desire will prove an effective stimulus to such increased skill and efficiency in management as will make lower prices to consumers probable. For its proper operation the conditions upon which the relation of price to dividend are established should be stable and likely to continue for a sufficient period to demonstrate the effectiveness of the incentives to good management. Otherwise the system will achieve little by way of actual regulation of price. The board has been of the opinion that the present extraordinary conditions are not likely to outlast the war, even assuming that pre-war conditions may not immediately be restored. Therefore it has seemed expedient in other cases to temporize by making such adjustments as may for the moment seem necessary, but to postpone until the return of normal conditions any final conclusions upon debatable rate questions. Such a policy seems applicable with even greater force to establishing a standard price under the sliding-scale plan."

# *Current News and Notes*

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

**Food Conservation by Floodlighting.**—A Los Angeles company recently ordered floodlighting projection for lighting rice fields at night to keep ducks and geese away.

**Rehabilitation of Disabled Soldiers and Sailors.**—The United States government, through its Board of Vocational Education, is calling for the coöperation of employers in the rehabilitation of 200,000 American men disabled in the war. It is the intention of the government to assist in replacing each man, regardless of his handicap, in suitable civil employment Free courses of instruction in all agricultural, industrial, commercial and professional occupations are being provided under the jurisdiction of the board, the intention being that the disabled man shall be qualified for a "real job," not a "temporary soft snap." Employers should address the board at Washington for details of the coöperative plans.

**Training for Department of Labor Examiners.**—A conference of far-reaching importance will be held in Washington, beginning Jan. 6, when the United States Employment Service of the Department of Labor opens a two weeks' normal training course for examiners. Upon the completion of the course those who have acceptably passed through it will be sent out as a trained and efficient staff to make standard the use of a common agency under the government for labor distribution and placement. Thirty employees of the Employment Service in fifteen states have been designated to take the first course, on completion of which they will be returned to their own states, so far as possible, and there will train their own examiners for service.

**Decorative Arts and Industries Association Formed.**—A number of the larger manufacturers of the country have just organized a National Association of Decorative Arts and Industries to raise national standards of taste in home furnishings. The organization meeting was held in New York City, and officers were elected as follows: President, James P. Haney, New York; vice-president, Henry W. Frohne, Grand Rapids, Mich.; secretary, William Laurel Harris, New York; treasurer, Chandler R. Clifford, New York. The constructive object of the society is to promote closer relations between manufacturers, jobbers and retailers of home furnishings all through the country by means of printed publicity, traveling exhibitions, lectures and trade and general information on furnishing the home. Through the association it is also planned to make exhibitions of good home furnishings in New York, Philadelphia, Boston, Chicago, St. Louis and other cities.

**Red Cross Instead of Banquet.**—The annual banquet of the Southern Public Utilities Company, Charlotte, N. C., which has long been a fixture with this company, will not be held this year. Instead, the company will present to each employee a membership in the American Red Cross, in keeping with the desire expressed a year ago by every employee, with a single exception. Last year the employee body voted, with one exception, to request the company to call off the banquet and to use the money to purchase memberships in the American Red Cross instead. This year it is felt that there is just as much necessity for concentrated effort toward the support of the nation in these trying times of reconstruction as there was for patriotic endeavor last year, and after having canvassed the large majority of the employees, and finding not a single one who prefers the banquet to the Red Cross membership, it has been decided to renew the memberships.

**Development of Foreign Trade.**—T. C. Powell, special representative of the United States Railroad Administration with the War Industries Board, in a letter on the development of foreign trade, says: "It appears to be the consensus of opinion that one outlet for the surplus capacity of the United States is in the direction of foreign trade, and with that thought in mind, for the purpose of ascertaining to what extent the manufacturers of the United States are interested in such foreign trade development, I am addressing this letter to a large number of the firms which in the course of the past year have had relations with the War Industries Board, as it seems advisable to establish a point of contact between the United States Railroad Administration and the exporters and importers of the country, to develop whether the administration can be of any substantial assistance." The Port and Harbor Facilities Commission, created by resolution of the United States Shipping Board in May, 1918, has been for months collecting all the information available with regard to facilities at the ports, and is coöperating with the Railroad Administration in preparing other data for consideration. Mr. Powell asks for suggestions and information regarding foreign trade, such as (a) character and volume of business, (b) country with which the foreign trade relations are to be established or extended, (c) relation between such development and the transportation facilities and rates of freight, and (d) any other data which will be of value to the administration or any individual railroad in preparing for such foreign commerce."

# *Recent Court Decisions*

Findings of higher courts in legal cases involving electric light, power and other public utility companies.

**Effect of Covenant Not to Sue.**—In action for death of telephone lineman against telephone company and a power company whose wire electrocuted him, if jury held power company negligent, it should, in assessing damages, credit to it $7,500 paid plaintiffs by the telephone company for a covenant not to sue, according to the Supreme Court of Mississippi in Bogdahn versus Pascagoula Street Railway & Power Company (78 S. 844).

**Evidence of Experts.**—Where a witness was asked his opinion as to the amount of voltage causing the death of plaintiff's intestate, and upon defendant's objection the court said it would be competent to ask the amount of voltage which would produce death, such suggestion was not objectionable as an expression of the judge's opinion upon the facts, according to the Supreme Court of North Carolina (97 S. 378). Where one of the chief issues for the jury was the amount of voltage passing through intestate's body from defendant's wires, it was not competent for a witness to state his opinion of the amount of such voltage. Where there was an issue for the jury as to the negligence of defendant city in installing a brass, instead of a porcelain, electric light socket in bottling works, it was not competent for an expert witness to answer questions calling for conclusions on the facts.

**Evidence Regarding Defective Insulation.**—In action for the death of an employee in a drug store who was killed by a service wire coming in contact with the primary wire carrying high voltage, testimony of a witness to the effect that wires were not properly insulated held by the Supreme Court of North Carolina within his immediate observation and experience, in Raulf versus Elizabeth City Electric Light & Power Company (97 S. E. 236). Asking an expert electrician "whether the conditions arising on the facts stated would naturally and inevitably lead to intestate's death" was not reversible error, there being no serious contention that if primary wire carrying 2300 volts came in contact with service wire running into store where intestate was employed it would produce death. Question asked expert electrician "whether the conditions arising on the facts stated would naturally and inevitably lead to intestate's death" was not objectionable as embodying the very fact that the jury was to pass upon, there being no dispute that if wire of high voltage came in contact with service wire it would cause death.

# *Men of the Industry*

Changes in Personnel and Position—Biographical Notes

**Prof. A. E. Kennelly** of Harvard University and the Massachusetts Institute of Technology has been elected an honorary member of the Institution of Electrical Engineers in Great Britain.

**W. D. Alley,** formerly with the Northern Indiana Gas & Electric Company of Hammond, Ind., has been appointed electric meter expert for the Southern Public Utilities Company, Charlotte, N. C.

**Nicholas Stahl,** formerly of the power department of the Westinghouse Electric & Manufacturing Company, has succeeded the late Martin W. Kern as general engineer of the Narragansett Electric Lighting Company, Providence, R. I.

**Major George F. Heustic,** formerly superintendent of the Malden (Mass.) Electric Company, established a new record in the American army. In sixteen and one-half hours of actual work an athletic field, seating 9000 people, was constructed under his direction at Camp Pike, Ark.

**Frank O. Emery** recently resigned his position as superintendent of the water and light department of the city of Reedsburg, Wis., to become general superintendent and electrical engineer of the Janesville (Wis.) Electric Company. Previous to his employment with the city of Reedsburg, Mr. Emery was with the Mineral Point (Wis.) Public Service Company for five years as superintendent and electrical engineer.

**John F. Killeen,** formerly in charge of the heating device section of the General Electric Company and more recently vice-president and sales manager of the Rathbone-Sard Electric Company, has become identified with the Edison Electric Appliance Company, Inc., Chicago. Mr. Killeen was associated with the General Electric Company in the development of the heating device business for ten years prior to becoming vice-president and sales manager of the Rathbone-Sard Electric Company two years ago.

**John Macfarlane** has recently been appointed chief engineer of the Scranton (Pa.) Electric Company. For two years after leaving school Mr. Macfarlane was associated with E. B. Cox testing stoker boilers and coal-handling machinery. Later he became a pump engineer with the Jeansville Iron Works and shortly afterward he became operating and construction engineer for the Harwood Electric Company, during the construction of the Hauto plant. Upon the completion of this plant he was appointed superintendent of all of the Harwood Electric Company's plants.

**Frederick Pearson,** who for the last fifteen years has been associated with Marshall Field & Company as advisory engineer in the development of their various manufacturing and merchandising enterprises in Chicago and elsewhere, has entered the practice of consulting engineering, with offices at 25 East Washington Street, Chicago. He will continue as advisory engineer to the above firm. Mr. Pearson's extensive engineering experience covers a period of about twenty years, five of which were spent in the design and installation of central stations and isolated plants. Later he was assistant to the consulting engineer for D. H. Burnham & Company, architects, Chicago. While Mr. Pearson has never been an opponent of the privately owned and operated plant, he was one of the first engineers in Chicago to realize the advantages offered by central-station service, and some years ago recommended the abandonment of the private plants operated by Marshall Field & Company and the transfer of the entire load to the central-station company, which load now aggregates approximately a consumption of 12,000,000 kw.-hr. annually. Mr. Pearson's experience includes electrical, mechanical and chemical engineering. He has had wide engineering and technical society affiliations and was a member both of the Electrical Congress in St. Louis in 1904 and of the International Chemical Congress, Chicago and Washington, in 1912.

## Obituary

**Lucien W. Carr,** superintendent of the Crawfordsville (Ind.) Electric Light & Power Company, died of acute indigestion Dec. 11.

**Edgar Wallace Bates,** superintendent of construction of the Plymouth (Mass.) Electric Light Company, died recently at Plymouth. Mr. Bates was well known in New England central-station circles, and his experience covered a wide range of activity in both engineering and commercial fields. He was born at Lynn, Mass., in 1864, and as a young man was sent to Australia for the old Thomson-Houston Electric Company, where he had charge of the company's display at the Melbourne Exhibition, and he operated the first electric car in that country in 1887-88. After his return to the United States he became superintendent of the Cohasset Electric Company, remaining at this post more than twenty years. About four years ago Mr. Bates went to Plymouth and took charge of the high-tension line construction between Plymouth, Marion and the Cape Cod Canal. He was a charter member of the New England Section of the National Electric Association and was a frequent attendant at its conventions. He was very highly regarded among electrical men in Massachusetts.

**Lieut. A. E. Granberg,** who prior to joining the army was employed in the New York office of the General Electric Company, died in France, Nov. 1, of pneumonia. Lieutenant Granberg was graduated in 1912 from Syracuse University as an electrical and mechanical engineer. He was at one time power engineer with the Rockford (Ill.) Electric Company.

**Jacob Bard,** chief engineer of the Sangamo Electric Company, and one of the best known electrical meter engineers of the country, died on Dec. 13 at his home in Springfield, Ill., from pneumonia. Mr. Bard was graduated from the University of Illinois in 1906 and, after a few years' work divided between the Western Electric Company and the Peoria Gas & Electric Company, he entered the employ of the Sangamo company in 1911, rapidly rising to have charge of all engineering matters, including development work, for that company. Mr. Bard was a member of the American Institute of Electrical Engineers.

**A. L. Hart,** in charge of the power sales department of the Metropolitan Edison Company of Reading, Pa., died of pneumonia on Dec. 13 at his home in Wyomissing, at the age of thirty years. Mr. Hart was one of the most capable men in the Metropolitan Edison Company's organization, with which he had been identified for seven years, and was a graduate of the Massachusetts Institute of Technology. His first employment was with the General Electric Company in the small-motor department at West Lynn, Mass. He first took up power sales work with the Pennsylvania Light, Heat & Power Company of Pottsville, Pa., in 1909, remaining for one year, when he went to Poughkeepsie, N. Y., to take up similar work, joining the Reading company in 1911 to manage its power sales department.

**Charles E. Phelps,** chief engineer of the Maryland Public Service Commission, died in Baltimore on Sunday. Mr. Phelps was born on Jan. 31, 1871, and in 1894 was graduated from the Johns Hopkins University in electrical and mechanical engineering. From 1894 until 1898 he was superintendent of electrical construction for the David E. Evans Company. He then engaged upon some private contract work, but upon the organization on Oct. 1, 1898, of the Electrical Commission of Baltimore he was appointed chief engineer. At the same time he represented a number of cities in technical matters principally relating to public utility corporations. In 1906 he was selected by the National Civic Federation, together with Theodore Stebbins, to conduct the investigation carried on by the federation into the question of municipal ownership and operation of public service corporations. He resigned from the Baltimore commission in 1910. In the fall of that year he was appointed chief engineer of the Maryland commission.

# TRADE & MARKET CONDITIONS

**News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies— Notes on Industrial Activities and Business Methods**

## ELECTRICAL SALES FOR 1918 IN NEIGHBORHOOD OF $750,000,000

### Indications Are that the Record Made in 1917 Has Not Been Surpassed by Any Considerable Amount This Year

As the current year comes to a close it becomes apparent that sales of electrical equipment billed in 1918 are not much greater, if greater at all, than those billed during the record year of 1917. In fact, in not a few instances it will be found that gross sales for 1918 are below those for 1917.

If the above is true, then the sales of electrical goods billed in 1918 will probably be found to run around $750,000,000.

A good many reasons can be found for sales not running higher. First, there was not the quantity of new factory space in 1918 that there was for 1917 production. Second, there was less commercial and more government purchasing. Third, the shortage of raw materials and labor reduced production in many lines. Fourth, conservation measures required curtailment in the output of a number of electrical products. Fifth, the signing of the armistice early in November caused a very large reduction in output. Sixth, government prices on raw materials brought lower average prices on certain lines, particularly wire, which has the largest output in dollars and cents of all electrical manufactures.

At the close of 1917 the unfilled orders on hand were very large. Some of these orders have not yet been filled. Unfilled orders now on hand are probably much smaller than they were a year ago. The close of the war brought many cancellations. All government contracts, however, were not canceled. The big government contract for outpost wire, for instance, still remains in the process of fulfillment.

When the new year opens the electrical manufacturing industry will find itself in a better condition to attract business than it has been in for the past two years. Once more it will be able to give service to buyers.

## DIFFERENCE OF OPINION OVER THE TREND OF PRICES

### Some Hold to Stiff Prices for Some Time, Others Desire Quick, Sharp Break, but General Gradual Decline Is Expected

There is a considerable difference of opinion among members of the trade regarding the future trend of prices of electrical goods. That prices will eventually go to lower levels none deny.

Some are firmly of the conviction that it will be some time before lower prices can reasonably be expected. Labor is still high. There are stocks on hand of raw materials that were laid in at the high prices. Besides, more were ordered which are either on the way or will be shipped within the next few months. Until these conditions are changed this group believe that prices must stay up. In the vacuum-cleaner and washing-machine lines particularly is this view strong.

One of the pioneers in the manufacture of electric washing machines a week or so ago stated that his machines, and they represent a substantial portion of the entire output of the country, would not be lower in price before the latter part of 1919. To this, of course, was attached the proviso "unless forced to by price lowering of competitors."

Contrary to this view is the hope expressed by many prominent men in the industry that prices will at once drop as far as they are going. These people, as a prominent insulated-wire manufacturer expressed it a few days ago, "want to take their loss all at once, get it over with and make it attractive to do business." This, of course, would involve lower prices all along the line down to raw materials and labor.

Those who hold this position, while they do not believe that it will come, say that the buyer will not be enticed into the market by a small decrease. Rather will a decrease lead him to expect still lower prices. To do things this way, these people state, is simply to postpone buying and in the meantime go through a long-drawn-out period of business hesitancy.

The view, however, that is coming to be held most generally is that prices from now on can be expected to fall not fast but surely. In some lines this has already happened. Insulated-wire base, for instance, has dropped slightly in the last few days. When the price of copper drops after the first of the year, as copper authorities say it will, other commodities where copper or brass plays a large part may be expected in some degree to follow the lead of wire.

Except for certain lines, few orders are now being received for electrical goods, and while the factories may have large quantities of unfilled orders, still incoming orders must be stimulated. Competitive conditions, therefore, may arise shortly.

A case came to light a few days ago in which an order for $25,000 worth of motors and substation equipment was about to be placed. The concern that received the order cut its price first 8 and finally 10 per cent in order to get the business. Moreover, it was said at the time that this was the first occasion in two years when the salesmen had been allowed to meet competition in that way.

While it is probably true that much business is going to be delayed waiting for further decreases, still this must be expected. So long as prices are to come down slowly, new business will be placed slowly. Manufacturers naturally then must protect themselves in their stocks.

## WHEN TO TURN OUT SPECIAL EQUIPMENT

### Lamp Manufacturer Points Out the Necessity of Effort in Order to Build Up the Good Will of Customers

Standardization of electrical equipment because of the need for conservation has been in force sufficiently long for manufacturers to wish the continuance thereof in a large degree. There are occasions, however, when special equipment may be necessary and then the manufacturer may feel justified in taking the order.

A New England lamp maker in discussing this matter recently pointed out the necessity to make some odd-type lamps, even at the cost of considerable annoyance due to the bother and unusual care required: "We must all appreciate," said the manufacturer, "that our customers, the people who buy and use our lamps and pay the company the money with which we pay the wages and other

expenses of the business, have some rights in this matter. In return for buying our lamps in the standard sizes they certainly have the right to call upon us to make up the odd-type lamps when there is a real need for them. You would not trade with your grocer long if he refused to supply you with kerosene, simply because it was bulky, hard to handle and carried a small profit, but asked you to buy from him only the articles which were profitable for him and which would not take up much of his time and energy in handling. Likewise our lamps would not build up much good will if we took the narrow attitude of refusing to accommodate customers by supplying some of the types of lamps that are a little difficult to manufacture."

A reasonable measure of protection is secured for the factory by the policy of refusing orders for special-type lamps from customers who do not buy standard lamps from the establishment in large quantities. In this factory it so happens that the number of special-type lamps is at present much larger than it appears likely the company will have to turn out in the future, as lamps now being made cover orders which it has not been feasible to fill for about two months.

## METAL MARKET SITUATION

### Market Continues Stagnant, with Prices Falling—Base Prices on Pig Tin to Stand

The metal market continues to drift without consumers showing any active interest, while the producers have so far appeared content to wait for overtures from the buyers. The impression is growing, however, that in the case of copper the time will be short before a basis is found for doing business on future orders. Bids of 23 cents per pound were mentioned frequently last week in trade discussion and again this week, and it is expected that producers will shortly seek to put their offerings somewhere in line with current bids.

The base prices on pig tin which were announced some days ago by the War Industries Board to continue until Jan. 31 will be continued until all of the tin now held by the United States Steel Products Company, the sole distributer in this country, has been disposed of. The market here continues stagnant with more outside lots being pressed for sale, with the result that lower prices for such lots are prevailing.

On Dec. 19 the War Industries Board announced that the government-fixed price on aluminum would remain in force until March 1, 1919, when it would expire by limitation. The market is very dull.

Spelter continues at an absolute standstill, and the trade cannot remember in years such a period of entire absence of inquiry on business. Prices are still softening.

Old metals have fallen considerably, and there are rumors of further cuts in prices, especially in the soft metals.

#### NEW YORK METAL MARKET PRICES

| | Dec. 17 | Dec. 23 |
|---|---|---|
| Copper: | | |
| London, standard spot | £ 122 0 0 | £ 122 0 0 |
| | Cents per Pound | Cents per Pound |
| Prime Lake | Govt. price 26.00 | Govt. price 26.00 |
| Electrolytic | Govt. price 26.00 | Govt. price 26.00 |
| Casting | Govt. price 26.00 | Govt. price 26.00 |
| Wire base | 28.75 | 28.75 |
| Lead, trust price | 7.05 | 6.50 |
| Antimony | 8.00 | 7.62½ |
| Nickel, ingot | 40.00 | 40.00 |
| Sheet zinc, f.o.b. smelter | 15.00 | 15.00 |
| Spelter, spot | 8.67½ | 8.47½ |
| Tin | 72.50 (official) | 71.75 |
| Aluminum, 98 to 99 per cent | Govt. price 33.10 | Govt. price 33.10 |

#### OLD METALS

| | Cents per Pound | Cents per Pound |
|---|---|---|
| Heavy copper and wire | 18.50 to 19.00 | 17.00 to 18.00 |
| Brass, heavy | 10.50 to 11.00 | 10.00 to 10.50 |
| Brass, light | 8.50 to 9.00 | 8.00 to 8.50 |
| Lead, heavy | 5.25 to 5.50 | 5.25 to 5.50 |
| Zinc, old scrap | 5.25 to 5.50 | 5.25 to 5.50 |

## THE WEEK IN TRADE

DURING the final week of holiday sales electrical goods took a spurt, and excellent sales are being reported by dealers from every part of the country. Up to a week or ten days ago the holiday sales had been very disappointing.

No new business of any importance is being placed with manufacturers, and jobbers are still marking time.

Prices generally are holding pretty firm, although wire is softening somewhat except for double-braid, in which a tendency to higher prices is seen.

The building market shows no signs of improvement or of an early opening. The mortgage-money market shows no signs of soon becoming more inviting to builders.

Deliveries on back orders are beginning to be made and are expected rapidly to increase.

## NEW YORK

Business the past week has been almost wholly confined to retail channels. While it is conceded that the stores have done a very large general Christmas trade this year, it is a matter of comment that the sale of electrical appliances, portable lamps, etc., has been distinctly disappointing. In jobbing and wholesale lines a noticeable slacking up is in evidence.

No great activity or new construction is looked for for some time. In certain sections there is considerable alteration work going on and this may grow to large proportions.

A favorite sign is seen in the awakening of automobile manufacture. This industry has in the past absorbed vast quantities of insulated wire, storage batteries, lamps, magnetos, electric self-starters and electric instruments.

Considerable activity in exports is developing all along the line. Many of the smaller manufacturers are becoming interested, and it is understood that already a very satisfactory volume of sales is being recorded.

**METERS.**—Domestic demand for meters at the present time is quiet, but this condition usually prevails just before and after the holidays. An increased demand is looked for after Jan. 1. Many country and suburban dwellings which had been finished during the latter part of the war period but not electrically connected are now coming into the market for watt-hour meters. Export inquiry for meters is excellent, and large shipments are being made to practically every country in Europe, South Africa, Australia and South America. Supplies are good and factory shipments are made in two weeks.

**TRANSFORMERS.**—Central-station demand is very slack, and there is practically no ordering. Better conditions are looked for in the spring. Supplies on hand are fair.

**WIRE.**—Stocks are growing in the larger sizes. Nos. 10 and 12 can be supplied but in no great quantity. No. 14 is still very scarce, and there are so many back orders on hand to be filled that it is doubtful if the market will be in shape much before February. Prices continue to soften and 33-cent and 32-cent bases are frequently mentioned. It is understood that one producer is quoting on a 30-cent base.

**SCHEDULE MATERIAL.**—Switches, cut-outs, etc., are in active demand for industrial plants which could not be supplied during the war. A particularly heavy demand from the rubber industry is noticed.

**AUTOMOBILE SUPPLIES.**—Manufacturers of electric instruments for automobiles have for the past two years been actively engaged on war contracts in other lines, noticeably

in radio equipment. Now that hostilities have ceased, automobile makers are again entering the market for instruments, but they are showing caution in buying and are not placing orders for more than two or three months ahead. Prices have advanced in the past two years about 30 per cent, half the advance taking place in 1918. Supplies on hand are limited, and deliveries take from four to six weeks.

**BATTERIES.**—Dry batteries continue to be in steady demand and factory stocks show improvement. Shipments are still behind, however, and cannot be made under two weeks. Flashlight battery orders are still well ahead of supplies, and shipments, it is reported by one concern, cannot be made under six weeks.

**LINE MATERIAL.**—Buying is still holding off, although the mild weather has been favorable for this class of work. One manufacturer has reduced his stock considerably by a large export order. Supplies on hand are good and deliveries prompt.

**WASHING MACHINES.**—Demand is still far ahead of production. Future orders on producers' books are very large. Prices are strong, and it is doubtful, manufacturers state, if, even with the reduction of the price of metals, there will be any change in the price of machines for some time to come. Shipments of the best makes of copper machines are still four weeks behind.

**HEATER CORD.**—Cord is slowly finding its way back into the market. Orders placed two months ago are being now about one-third filled.

## BOSTON

Business continues quiet, but little apprehension is felt as to the future. Electrical contractors report many prospects in sight for new or reconstruction work, and a good deal of estimating is being called for. Jobbers are well stocked and until the New Year arrives will not be in the market for material on any large scale. Collections continue fair and very little complaint is now heard as to deliveries. Prices are being shaded here and there in order to keep goods moving, but no general reductions are as yet to be seen. The opinion is widespread, however, that material decreases in price will feature the early 1919 market. Labor conditions are more unsettled this week. A serious strike is in progress at the Pittsfield works of the General Electric Company in sympathy with the strikes in progress at Schenectady and Erie. At the Lynn works of this company the employees have remained at their posts up to this writing.

**MOTORS.**—Stocks are increasing as the demand slackens, and prices remain about the same. The market is meeting the transition period well. Some motors are being thrown upon the market through auction sales, but not much disturbance appears to result.

**BATTERY-CHARGING EQUIPMENT.**—An active demand is reported, especially for industrial electric truck charging service. Deliveries are quoted at from thirty to fifty days, with steady prices.

**STORAGE BATTERIES.**—Stocks are increasing and the falling off of government demands is being turned to good account for the civilian trade. The automobile battery trade is in exceptionally good condition, the open winter being reflected in local sales. The factories are busy filling orders of long standing, and it is expected that prices will remain firm for some time.

**PORTABLE LAMPS.**—Trade is unusually brisk, and the holiday demand has been excellent. One central station reports the sale of about 600 portables since Sept. 1. The supply at the beginning of the holiday season was larger than usual.

**WASHING MACHINES.**—Deliveries are steadily improving, and a fine year's business is anticipated for 1919. The demand holds up well.

**VACUUM CLEANERS.**—Business is good and bids fair to remain so. Special campaign work by central stations is now under way and the response is gratifying.

**FRICTION TAPE.**—Stocks are improving. It is anticipated that prices will be a little easier within a few days.

**CONDUITS.**—Boston jobbers are still low as to conduit supply. Not much buying is being done at present, the opinion being held in some quarters that it would be well to wait for a reduction in prices. As a matter of fact, there is reason to believe that prices will hold firm around present levels for some time to come, and that while merchant pipe may show a moderate reduction in January, the "spread" between merchant pipe and conduit is such that very little change will be seen in the latter.

**FLASHLAMPS AND DRY CELLS.**—A rushing holiday trade is being handled in flashlamps. Dealers report that the shortage in lamps and dry cells has now been overcome.

**LAMPS.**—The demand is heavy for the new 25-watt and 50-watt mill type lamps for use in industrial plants where vibration is encountered. Stocks of the ordinary sizes of lamps are in good shape for immediate delivery. Some shortage in gas-filled lamps of the 75-watt and 100-watt sizes is reported as regards delivery from local stocks. The manufacturers are catching up with the demand for miniature lamps. Sign lamps are moving very slowly, contrary to expectations when the lighting restrictions were removed; in fact, there is a disposition to do away with carrying local stocks of sign lamps in the coming year.

## CHICAGO

Holiday trade ran into record-breaking figures this week. Sales of electrical appliances are reported to be high, conditions pointing to a big electrical labor-saving Christmas. War wages and the proceeds of bountiful crops at high prices are pouring into retail stores in volume never before known, and electric shops are getting their share. This is true not only in Chicago but in the Middle West generally.

Wholesale business is dull, as usual at this time of year, but there does not seem to be any evidence of unrest, the general tone of the trade being confident.

Collections are uniformly good and there is a tendency toward easier financial conditions.

**BELTING.**—A manufacturer of a substitute for leather belting is doubling his output for 1919 in anticipation of a healthy demand.

**BELL-RINGING TRANSFORMERS.**—Demand continues good. One concern that builds 500 of these transformers a day reports that it is 15,000 behind in deliveries. The daily output will be increased after Jan. 1.

**WASHING MACHINES.**—Several manufacturers report that deliveries would be better were it not for the difficulty of obtaining wringers. However, the general condition is better than it has been for the past year.

**PORTABLE LAMPS.**—Demand and deliveries for the medium and low-priced lamps are reported good.

**SMALL MOTORS.**—Deliveries are much better, and manufacturers are looking for new applications and new outlets.

**CHRISTMAS-TREE LAMPS.**—There appears to have been a heavy demand for tree-lighting outfits. Dealers were prepared and had good stocks. The shortage this season will be in Christmas trees, not lighting outfits.

## ATLANTA

Manufacturers and jobbers are feeling the effect of the pre-inventory period, not to mention the hesitancy on the part of buyers due to expected decline in prices. Business as a whole has decreased decidedly during the last two weeks. Certain items, however, such as street lighting and meters, have shown up much better than was expected. Retailers and dealers are doing an excellent holiday business. Conclusions drawn from all sources of activity this week show that buying, on the whole, is light and that the re-

tailers are cleaning up stocks as fast as possible before the first of the year. Practically all branches of the metal market are marking time, awaiting readjustments of prices incident to a return of peace conditions.

Assurances have been given Southeastern commercial interests that a fair proportion of the million tons of cargo tonnage to be turned over immediately will be available for the movement of cotton. Ports such as Newport News, Wilmington, Charleston, Savannah and Brunswick are certain to draw increased business under the new policy. At this time the South is especially interested in cotton, and federal assurances regarding the tonnage allocation will promote a more cheerful feeling in all lines of trade, as this section is still shackled by the single-crop idea. Ten additional buildings of steel and tile structure will be erected at the United States naval air station, Galveston, Tex. The Columbia-Panama Coal Company, Manchester, Ky., has purchased additional land, and an electric road will be built, together with a power plant.

An item of especial interest to the electrical industry at this time is the spirit of optimism that prevails throughout the textile field, as a large volume of business is transacted annually with this industry. The consensus of opinion gathered from a number of interviews indicates that textile men expect a slight slowing up in demand for their goods during the early part of 1919, but from then on the business will gradually come back to a pace nearly equal to the past two years.

**TRANSFORMERS.**—There is no apparent decrease in the call for distributing type. Stocks are in good condition, and replacement shipments are coming through nicely. Activity in large-power types has dropped away off.

**METERS.**—Some of the manufacturers state that orders for residence type have shown improvement of late. This increase is coming from the smaller central stations. Stocks are ample. Very few transactions are being handled in switchboard instruments.

**STREET LIGHTING.**—There is more activity noted in this line. The demand for fixtures is increasing from all quarters. Deliveries are good.

**WIRE.**—Pressure has not subsided for rubber-covered or weatherproof. No difficulty is experienced in getting weatherproof, but shipments of rubber-covered are slow. Heavy sizes and cables have slumped off considerably. This is to be expected, however, at this time of the year.

## SEATTLE—PORTLAND

Wholesale and jobbing trade during the past week showed a slight decrease, but retail trade showed an enormous increase. Retail Christmas sales are exceptionally heavy and going strong. Domestic appliance sales for presents, according to prominent retailers, will, contrary to expectations, nearly equal last year's mark. Toasters, irons, curling irons and percolators are moving especially heavy, followed closely by washing and sewing machines. Wholesale business to shipyards, industrials and lumber mills has slowed up considerably. This decrease is natural at this period and will not be prolonged. Shipyards will be closed down for Christmas and New Year's, but mills and logging camps will remain idle for two weeks. Northwest lumbermen are optimistic over prospects, anticipating steady and increasing demands beginning shortly after the first of the year.

Spokane electrical dealers report good business, and the outlook is favorable. Retailers in Spokane and vicinity report good holiday business. Tacoma wholesale and retail trade is fair. Holiday sales are heavier than anticipated. Portland district reports trade as good in the aggregate, although individual purchases are small. Retail buying showed an increasing strength.

Some of the wooden shipbuilding plants in the Portland district are unable to secure other contracts and are compelled to go out of business. There will undoubtedly be a considerable amount of electrical equipment thrown on the market. It is very questionable whether this equipment will be picked up directly by dealers on account of price, owing to the uncertainty with regard to what effect future conditions will have on the matter of lowering prices of all machinery. This will probably necessitate the taking of this machinery on consignment by local dealers or sale by owners to new customers. At the present time manufacturers and jobbers are to a large extent overstocked on these lines owing to the sudden cessation of hostilities. The general feeling therefore is that for a period of six months to a year there will be considerable marking of time in all lines of work.

Seattle is the only Pacific Coast city to show an increase over the month of November of last year in building. During the past week the number of permits decreased slightly, but it is believed that December will exceed the same month of last year by a comfortable margin. The campaign to build 2000 residences in Portland is under way. Two shipyards in Portland plan an immediate expansion of their plants, and the Foundation Company, operating wooden shipyards in Tacoma and Portland, plans the conversion of its wooden plant to steel. According to present plans, the Tacoma plant will have eight ways and the Portland plant six. The French government is reported to have closed negotiations with the Foundation Company for the construction of 174 ships valued at $100,000,000.

## SAN FRANCISCO

The demand for household electrical appliances in California increased by leaps and bounds during the past year, and now that the restriction of war time has been removed, this branch of the electrical trade has increased out of proportion to all others. Christmas buying of electrical merchandise in San Francisco has been heavier than for several years past. The threatened recurrence of the influenza epidemic last week helped to induce early shopping in order to avoid the rush. However, the influenza situation improved so much that it did not affect shopping during the last few days before Christmas. Christmas tree sets were sold out early last week and no more could be obtained. Otherwise stocks of Christmas electrical goods were generally in good condition. A notable difference in the demand is apparent this year and is ascribed to the change from a war to a peace basis. Appliances of the less necessary sort are called for, and high cost is apparently not a drawback with goods of high quality. Expensive appliances, such as percolators and chafing dishes, are moving well, although the demand for them has been light for a long time.

An electrical contractors' licensing bill is being prepared by the Industrial Accident Commission of California and will be presented at this session of the Legislature supported by the Electrical Contractors' Association. The bill is expected to eliminate an undesirable element in the contracting business and to improve the conditions under which electrical construction work is done, particularly on small jobs.

Camp Frémont at Palo Alto is being dismantled. This is exceptional, as there is remarkably little abandonment of war-time construction in California and such as there is will affect stocks rather than prices.

In a report made public last week Major Sever, Pacific Coast representative of the War Industries Board, power section, recommended the development each year in California of an additional 50,000 hp. of hydroelectric power. The report is the result of five months of investigation and states that the extensive development must begin immediately to take care of power demands that are resulting from normal growth.

Electrical accessories for automobiles is a branch of the industry that has gained prominence rapidly in California of late. Some electrical contractors have built up an attractive side line by specializing in repairs and supplies, including everything electrical about the automobile.

Credits and collections are very good. Credit departments report that small contractors and dealers seem to be doing a paying business and are now more prompt in meeting bills than they were a year ago.

# Current Prices of Electrical Supplies

## *New York and Chicago Quotations*

THE prices quoted are those prevailing in standard packages of specified lots on apparatus and appliances in Eastern and Middle West markets at the beginning of business on Monday of this week. They are in all cases the net prices or prices subject to discounts from standard lists of contractors, central stations, dealers and others engaged in the resale of such goods.

Prices in Southern and other nearby markets will rule about the same as those in the Middle West, although slight modifications to cover increased freight and local demands should be expected. In the Far West and on the Pacific Coast the prevailing prices are naturally higher, covering as they must increased freight and the necessity of larger stocks with increased interest and warehouse charges on account of the distances from sources of supply, infrequent turnover of stock and uncertainty as to delivery of goods in transit. Moreover, the Far West presents a wide variation in demand due to a small population spread over a wide area in agricultural and mining communities, as contrasted with the denser population of the East and Middle West, their nearness to the sources of supply, the more frequent turnover in stocks and the constant demands which arise in industrial centers. Price variations may be due to difference in grade of products of different manufacturers, to local conditions, or to both.

### ARMORED CONDUCTOR, FLEXIBLE STEEL

*Single-Conductor*

| B. & S. Size | List per 1000 Ft. |
|---|---|
| No. 14 solid | $61.00 |
| No. 12 solid | 71.00 |
| No. 10 solid | 90.00 |
| No. 8 solid | 106.00 |
| No. 6 solid | 145.00 |
| No. 10 stranded | 95.00 |
| No. 8 stranded | 115.00 |
| No. 6 stranded | 160.00 |
| No. 4 stranded | 205.00 |
| No. 2 stranded | 266.00 |
| No. 1 stranded | 315.00 |

*Twin-Conductor*

| | |
|---|---|
| No. 14 solid | 104.00 |
| No. 12 solid | 135.00 |
| No. 10 solid | 185.00 |
| No. 8 stranded | 235.00 |
| No. 6 stranded | 370.00 |
| No. 4 stranded | 575.00 |

### NET PRICE AND DISCOUNT PER 1000 FT.—NEW YORK

*Single-Conductor*

| | No. 14 Solid |
|---|---|
| Less than coil | List |
| Coil to 1000 ft | 10% |
| | **No. 12 Solid** |
| Less than coil | List |
| Coil to 1000 ft | 10% |

*Twin-Conductor*

| | No. 14 Solid |
|---|---|
| Less than coil | List |
| Coil to 1000 ft | 10% |
| | **No. 12 Solid** |
| Less than coil | List |
| Coil to 1000 ft | 10% |

### DISCOUNT—CHICAGO

*Single-Conductor*

| | No. 14 Solid |
|---|---|
| Less than coil | +30% to +20% |
| Coil to 1000 ft | List |
| | **No. 12 Solid** |
| Less than coil | +30% to +20% |
| Coil to 1000 ft | List |

*Twin-Conductor*

| | No. 14 Solid |
|---|---|
| Less than coil | $115.00 |
| Coil to 1000 ft | 100.00 |
| | **No. 12 Solid** |
| Less than coil | +30% to +20% |
| Coil to 1000 ft | List |

### ATTACHMENT PLUGS

List ranges from $0.22 to $0.30 each.
Standard packages from 100 to 250.

### DISCOUNT—NEW YORK

| | |
|---|---|
| Less than 1/5 std. pkg | +20% |
| 1/5 to std. pkg | List |
| Std. pkg | 15% to 17% |

### DISCOUNT—CHICAGO

| | |
|---|---|
| Less than 1/5 std. pkg | +30% to List |
| 1/5 to std. pkg | +5% to 20% |
| Std. pkg | 18% to 30% |

### BATTERIES, DRY

NEW YORK

| Each Net | No. 6 Regular | No. 6 Ignitor |
|---|---|---|
| Less than 12 | $0.45—$0.46 | $0.45—$0.47 |
| 12 to 50 | .40 | .40— .41 |
| 50 to barrel | .35— .36 | .36— .37 |
| Barrel lots | .32— .329 | .33— .339 |

### BATTERIES, DRY—Continued

CHICAGO

| Each Net | No. 6 Regular | No. 6 Ignitor |
|---|---|---|
| Less than 12 | $0.40 to $0.45 | $0.40 to $0.45 |
| 12 to 50 | .35 to .38 | .35 to .38 |
| 50 to barrel | .319 to .35 | .329 to .35 |
| Barrel lots | .289 to .32 | .299 to .32 |

### CONDUIT, METALLIC FLEXIBLE

| Size, In. | Ft. per Coil | List per 100 Ft. |
|---|---|---|
| ⅜ | 250 | $5.00 |
| ½ | 250 | 7.50 |
| ¾ | 100 | 10.00 |
| ¾ | 50 | 13.00 |
| 1 | 50 | 21.00 |
| 1¼ | 50 | 26.00 |
| 1½ | 25–50 | 35.00 |
| 2 | 25–50 | 45.00 |
| 2½ | 25–50 | 52.00 |

### NET PER 1000 FT.—NEW YORK

| | Less than Coil | Coil to 1000 Ft. |
|---|---|---|
| ⅜-in. single trip | $75.00 | $63.75— 69.75 |
| ⅜-in. double strip | 75.00— 82.50 | 72.00— 75.00 |
| ½-in. single strip | 100.00 | 85.00— 93.00 |
| ½-in. double strip | 100.00—110.00 | 96.00—100.00 |

### NET PER 1000 FT.—CHICAGO

| | Less than Coil | Coil to 1000 Ft. |
|---|---|---|
| ⅜-in. single strip | $75.00 | $63.25 to $63.75 |
| ⅜-in. double strip | 78.25 to $78.75 | 71.25 |
| ½-in. single strip | 100.00 | 75.00 to 85.00 |
| ½-in. double strip | 105.00 | 93.00 to 95.00 |

### CONDUIT, NON-METALLIC FLEXIBLE

| Size, In. | List per Foot | Size, In. | List per Foot |
|---|---|---|---|
| ⅜ | $0.05½ | 1 | $0.25 |
| ½ | .06 | 1¼ | .33 |
| ¾ | .09 | 1½ | .40 |
| ¾ | .12 | 1¾ | .47 |
| ¾ | .15 | 2 | .55 |
| ¼ | .18 | 2½ | .65 |

### NET PER 1000 FT.—NEW YORK

| | Less than $15 List | $15 to $60 List | $60 to $150 List |
|---|---|---|---|
| ⅜-in.— | $25.00–50.70 | $24.60–35.20 | $23.00–30.25 |
| ½-in.— | 30.00–56.40 | 28.00–38.40 | 26.00–33.00 |

### NET PER 1000 FT.—CHICAGO

| | Less than $15 List | $15 to $60 List | $60 to $150 List |
|---|---|---|---|
| ⅜-in.— | $60.00 | $30.00 | $26.00–29.15 |
| ½-in.— | 65.00 | 33.50 | 29.00 |

### CONDUIT, COUPLINGS AND ELBOWS, RIGID IRON

*Card No. 40*

| Size, In. | Conduit, List per Foot |
|---|---|
| ¼ | $0.08½ |
| ⅜ | .08½ |
| ½ | .08½ |
| ¾ | .11½ |
| 1 | .17 |
| 1¼ | .23 |
| 1½ | .27½ |
| 2 | .37½ |
| 2½ | .58½ |
| 3 | .76½ |

### CONDUIT, COUPLINGS AND ELBOWS, RIGID IRON—Continued

| Size, In. | Couplings, List | Elbows, List |
|---|---|---|
| ¼ | $0.05 | $0.19 |
| ⅜ | .06 | .19 |
| ½ | .07 | .19 |
| ¾ | .10 | .25 |
| 1 | .13 | .37 |
| 1¼ | .17 | .45 |
| 1½ | .21 | .50 |
| 2 | .28 | 1.10 |
| 2½ | .40 | 1.80 |
| 3 | .60 | 4.80 |

### DISCOUNT—NEW YORK

| | ¼ in. to ½ in. | ¾ in. to 3 in. |
|---|---|---|
| Less than 2500 lb | 7% to 7.1% | 9% to 9.1% |
| 2500 to 5000 lb | 10% to 10.1% | 12% to 12.1% |

(For galvanized deduct six points from above discounts.)

### DISCOUNT—CHICAGO

| | ¼ to ½ In. | ¾ to 3 In. |
|---|---|---|
| Less than 2500 lb | +5.5% to 3.5% | +3.5% to +1.5% |
| 2500 to 5000 lb | +2.5% to +0.5% | +5% to 1.5% |

(For galvanized deduct six points from above discounts.)

### FLATIRONS

NEW YORK

| | |
|---|---|
| List price | $6.00 to $6.50 |
| Discount | 20% to 25% |

CHICAGO

| | |
|---|---|
| List price | $6.00 to $7.00 |
| Discount | 20% to 30% |

### FUSES, INCLOSED

| 250-Volt | Std. Pkg. | List |
|---|---|---|
| 3-amp. to 30-amp. | 100 | $0.25 |
| 35-amp. to 60-amp. | 100 | .35 |
| 65-amp. to 100-amp. | 50 | .90 |
| 110-amp. to 200-amp. | 25 | 2.00 |
| 225-amp. to 400-amp. | 25 | 3.60 |
| 450-amp. to 600-amp. | 10 | 5.50 |
| **600-Volt** | | |
| 3-amp. to 30-amp. | 100 | $0.40 |
| 35-amp. to 60-amp. | 100 | .60 |
| 65-amp. to 100-amp. | 50 | 1.50 |
| 110-amp. to 200-amp. | 25 | 2.50 |
| 225-amp. to 400-amp. | 25 | 5.50 |
| 450-amp. to 600-amp. | 10 | 8.00 |

### DISCOUNT—NEW YORK

| | |
|---|---|
| Less than 1/5 std. pkg | 30% |
| 1/5 to std. pkg | 41% |

### DISCOUNT—CHICAGO

| | |
|---|---|
| Less than 1/5 std. pkg | 30% |
| 1/5 to std. pkg | 40% to 41% |

### FUSE PLUGS

*3-Amp. to 30-Amp.*

NEW YORK

| | Per 100 Net |
|---|---|
| Less than 1/5 std. pkg | $6.00 to $8.75 |
| 1/5 to std. pkg | 5.50 to 7.00 |

Standard packages, 500. List, each, $0.07

CHICAGO

| | Per 100 Net |
|---|---|
| Less than 1/5 std. pkg | $8.00 |
| 1/5 to std. pkg | 7.00 |

Standard packages, 500. List, each, $0.07

## LAMPS, MAZDA OR TUNGSTEN

*110 to 125 Volts*

| Regular, Clear: | Std. Pkg. | List, Each |
|---|---|---|
| 10 to 40-watt—B | 100 | $0.35 |
| 60-watt—B | 100 | .40 |
| 100-watt—B | 24 | .85 |
| 75-watt—C | 50 | .70 |
| 100-watt—C | 24 | 1.10 |
| 200-watt—C | 24 | 2.20 |
| 300-watt—C | 24 | 3.25 |
| Round Bulbs, 3½-in., Frosted: | | |
| 15-watt—G 25 | 50 | .60 |
| 25-watt—G 25 | 50 | .60 |
| 40-watt—G 25 | 50 | .60 |
| Round Bulbs, 3½-in., Frosted: | | |
| 60-watt—G 30 | 24 | .82 |
| Round Bulbs, 4½-in., Frosted: | | |
| 100-watt—G 35 | 24 | 1.15 |

### DISCOUNT—NEW YORK

| | |
|---|---|
| Less than std. pkg. | List |
| Std. pkg. | 10% |

### DISCOUNT—CHICAGO

| | |
|---|---|
| Less than std. pkg. | List |
| Std. pkg. | 10% |

## LAMP CORD

*Cotton-Covered, Type C, No. 18*

### NEW YORK

| | Per 1000 Ft. Net |
|---|---|
| Less than coil (250 ft.) | $30.47—$40.77 |
| Coil to 1000 ft. | 27.42— 32.98 |

### CHICAGO

| | Per 1000 Ft. Net |
|---|---|
| Less than coil (250 ft.) | $38.00 |
| Coil to 1000 ft. | 28.00 |

## LAMP GUARDS, WIRE

Standard packages from 50 to 150

### NEW YORK

| | |
|---|---|
| Net per 100 | $24.00 to $33.00 |

### CHICAGO

| | |
|---|---|
| Net per 100 | $23.93 to $30.00 |

## OUTLET BOXES

| Nos. | List per 100 |
|---|---|
| 101—A, A 1½, 4 S.C., 6200, 320 | $30.00 |
| 102—B.A., 6200, S.E., 300, A.X., 1½, 4 S. | 30.00 |
| 103—C.A., 9, 4R, B 1½ | 25.00 |
| 106—F.A., 7, C.S., 1½, 3 R | 20.00 |

### DISCOUNT—NEW YORK

| | Black | Galvanized |
|---|---|---|
| Less than $10.00 list | 26% | 20% |
| $10.00 to $50.00 list | 36% | 31% |

### DISCOUNT—CHICAGO

| | Black | Galvanized |
|---|---|---|
| Less than $10.00 list | 20% | 10% |
| $10.00 to $50.00 list | 30% | 20% |

## PIPE FITTINGS

### DISCOUNT—NEW YORK

| | |
|---|---|
| Less than 1/5 std. pkg. | 10% |
| 1/5 to std. pkg. | 20% |
| Std. pkg. | 30% |

### DISCOUNT—CHICAGO

| | |
|---|---|
| Less than 1/5 std. pkg. | 5% |
| 1/5 to std. pkg. | 15% |
| Std. pkg. | 25% |

## PORCELAIN CLEATS—UNGLAZED

*Two and Three Wire*

### NEW YORK

| | Per 1000 Net |
|---|---|
| Less than 1/5 std. pkg. | $20.00 to $21.00 |
| 1/5 to std. pkg. | 17.00 to 17.85 |

Standard package, 2200. List per 1000, $21 to $34

### CHICAGO

| | Per 1000 Net |
|---|---|
| Less than 1/5 std. pkg. | $21.00 |
| 1/5 to std. pkg. | 17.85 |

Standard package, 2200. List per 1000, $20.00–21.00

## PORCELAIN KNOBS

### NEW YORK

| Per 1000 Net. | Std. Pkg. 3500 5½ N.C.—Solid Nail-it—N.C. | Std. Pkg. 4000 N.C. |
|---|---|---|
| Less than 1/5 std. pkg. | $16.00 | $32.00 |
| 1/5 to std. pkg. | 13.60 | 27.20 |

### CHICAGO

| Per 1000 Net. | Std. Pkg. 3500 5½ N.C.—Solid Nail-it—N.C. | Std. Pkg. 4000 N.C. |
|---|---|---|
| Less than 1/5 std. pkg. | $13.00 | $32.00 |
| 1/5 to std. pkg. | 11.50 | 27.20 |

## SOCKETS AND RECEPTACLES

| | Std. Pkg. | List |
|---|---|---|
| ½-in. cap key and push sockets | 500 | $0.33 |
| ½-in. cap keyless socket | 500 | .30 |
| ½-in. cap pull socket | 250 | .60 |

### DISCOUNT—NEW YORK

| | |
|---|---|
| Less than 1/5 std. pkg. | +20% |
| 1/5 to std. pkg. | List |

### DISCOUNT—CHICAGO

| | |
|---|---|
| Less than 1/5 std. pkg. | List |
| 1/5 std. pkg. | 10% |

## SWITCHES, KNIFE

*250-Volt, Front Connections, No Fuse*

| | |
|---|---|
| High Grade: | |
| 30-amp. S. P. S. T. | $0.80 |
| 60-amp. S. P. S. T. | 1.20 |
| 100-amp. S. P. S. T. | 2.25 |
| 200-amp. S. P. S. T. | 3.48 |
| 300-amp. S. P. S. T. | 5.34 |
| 30-amp. D. P. S. T. | 1.20 |
| 60-amp. D. P. S. T. | 1.78 |
| 100-amp. D. P. S. T. | 3.38 |
| 200-amp. D. P. S. T. | 5.20 |
| 300-amp. D. P. S. T. | 8.00 |
| 30-amp. 3 P. S. T. | 1.80 |
| 60-amp. 3 P. S. T. | 2.68 |
| 100-amp. 3 P. S. T. | 5.08 |
| 200-amp. 3 P. S. T. | 7.80 |
| 300-amp. 3 P. S. T. | 12.00 |
| Low Grade: | |
| 30-amp. S. P. S. T. | $0.42 |
| 60-amp. S. P. S. T. | .74 |
| 100-amp. S. P. S. T. | 1.50 |
| 200-amp. S. P. S. T. | 2.70 |
| 30-amp. D. P. S. T. | .68 |
| 60-amp. D. P. S. T. | 1.22 |
| 100-amp. D. P. S. T. | 2.50 |
| 200-amp. D. P. S. T. | 4.50 |
| 30-amp. 3 P. S. T. | 1.02 |
| 60-amp. 3 P. S. T. | 1.84 |
| 100-amp. 3 P. S. T. | 3.76 |
| 200-amp. 3 P. S. T. | 6.76 |

### DISCOUNT—NEW YORK

| | High Grade |
|---|---|
| Less than $10 list | +15% to +10% |
| $10 to $25 list | 2% to 5% |
| $25 to $50 list | 5% to 10% |
| | Low Grade |
| Less than $10 list | +5% to list |
| $10 to $25 list | 8% to 15% |
| $25 to $50 list | 15% to 20% |

### DISCOUNT—CHICAGO

| | High Grade |
|---|---|
| Less than $10 list | + 15% |
| $10 to $25 list | List to 2% |
| $25 to $50 list | 5% |
| | Low Grade |
| Less than $10 list | +5% |
| $10 to $25 list | 8% |
| $25 to $50 list | 15% to 16% |

## SWITCHES, SNAP AND FLUSH

*5-Amp. and 10-Amp., 125-Volt Snap Switches*

| | Std. Pkg. | List |
|---|---|---|
| 5-amp. single-pole | 250 | $0.28 |
| 5-amp. single-pole, ind. | 250 | .32 |
| 10-amp. single-pole | 100 | .48 |
| 10-amp. single-pole, ind. | 100 | .54 |
| 5-amp. three-point | 100 | .54 |
| 10-amp. three-point | 50 | .76 |
| 10-amp., 250-volt, D. P. | 100 | .66 |

*10-Amp., 250-Volt Push-Button Switches*

| | Std. Pkg. | List |
|---|---|---|
| 10-amp. single-pole | 100 | $0.45 |
| 10-amp. three-way | 50 | 70 |
| 10-amp. double-pole | 50 | .70 |

## SWITCHES, SNAP AND FLUSH—Continued

### DISCOUNT—NEW YORK

| | |
|---|---|
| Less than 1/5 std. pkg. | +20% |
| 1/5 to std. pkg. | List |
| Std. pkg. | 15% to 17% |

### DISCOUNT—CHICAGO

| | |
|---|---|
| Less than 1/5 std. pkg. | List to 10% |
| 1/5 to std. pkg. | 10% to 16½% |
| Std. pkg. | 18% to 25% |

## SWITCH BOXES, SECTIONAL CONDUIT

| Union and Similar— | List Each |
|---|---|
| No. 155 | $0.34 |
| No. 160 | .60 |

### DISCOUNT—NEW YORK

| | Black | Galvanized |
|---|---|---|
| Less than $2.00 list | Net to 18% | Net |
| $2.00 to $10.00 list | 10% to 28% | 5% |
| $10.00 to $50.00 list | 20% to 45% | 10% |

### DISCOUNT—CHICAGO

| | Galvanized | Black |
|---|---|---|
| Less than $2.00 list | 25% to 40% | 20% to 30% |
| $2.00 to $10.00 list | 25% to 50% | 20% to 40% |
| $10.00 to $50.00 list | 25% to 64% | 20% to 52% |

## TOASTERS, UPRIGHT

### NEW YORK

| | |
|---|---|
| List price | $6.00 to $6.50 |
| Discount | 20% to 25% |

### CHICAGO

| | |
|---|---|
| List price | $6.50 to $7.00 |
| Discount | 20% to 30% |

## WIRE, ANNUNCIATOR

### NEW YORK

| | Per Lb. Net |
|---|---|
| No. 18, less than full spools | $0.55–$0.66 |
| No. 18, full spools | .53– .56 |

### CHICAGO

| | Per Lb. Net |
|---|---|
| No. 18, less than full spools | $0.65 to $0.75 |
| No. 18, full spools | .55 to .635 |

## WIRE, RUBBER-COVERED, N. C.

*Solid-Conductor, Single-Braid*

### NEW YORK

| | Price per 1000 Ft. Net | | |
|---|---|---|---|
| No. | Less than 500 Ft. | 500 to 1000 Ft. | 1000 to 5000 Ft. |
| 14 | $20.00–$25.00 | $13.50–$17.00 | $12.50–$15.00 |
| 12 | 25.00– 27.09 | 22.50– 23.22 | 18.75– 23.22 |
| 10 | 31.26– 32.40 | 28.66– 32.40 | 25.00– 27.45 |
| 8 | 43.92– 45.72 | 40.26– 45.72 | 35.14– 38.10 |
| 6 | 63.69– 72.36 | 57.90– 60.30 | 55.58– 57.88 |

### CHICAGO

| | Price per 1000 Ft. Net | | |
|---|---|---|---|
| No. | Less than 500 Ft. | 500 to 2500 Ft. | 2500 to 5000 Ft. |
| 14 | $25.00 | $18.00–$25.00 | $15.50 |
| 12 | $29.46– 31.44 | 29.46– 31.44 | $25.54– 31.44 |
| 10 | 41.10– 43.84 | 41.10– 43.84 | 34.62– 38.36 |
| 8 | 57.00– 61.76 | 57.00– 61.76 | 50.18– 54.04 |
| 6 | 85.31– 97.68 | 85.31– 85.47 | 77.21– 85.47 |

## WIRE, WEATHERPROOF

*Solid-Conductor, Triple-Braid, Size 4/0 to 3 Inc.*

### NEW YORK

| | Per 100 Lb. Net |
|---|---|
| Less than 25 lb. | $39.75 |
| 25 to 50 lb. | 39.75 |
| 50 to 100 lb. | 38.75 |

### CHICAGO

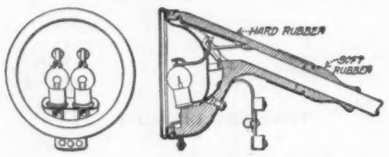
| | Per 100 Lb. Net |
|---|---|
| Less than 25 lb. | $39.76 to $41.00 |
| 25 to 50 lb. | 38.76 to 40.00 |
| 50 to 100 lb. | 37.76 to 39.00 |

# NEW APPARATUS & APPLIANCES

## A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

### Mine Lamp of Sturdy Construction

The "Wheat" electric mine lamp for use wherever explosive mixtures of gas or dust and air are encountered, or where corrosive atmospheres are prevalent, will be shortly placed upon the market by the Koehler Manufacturing Company, Marlboro, Mass. Comprising a storage battery for belt carriage and a two-bulb reflector lamp fitting the lamp




EXTRA LAMP PROVIDES FOR EMERGENCY

bracket on the customary miner's cap, the outfit weighs slightly over 4 lb. (1.8 kg.) and is strongly constructed to withstand severe service.

The battery, of the lead acid type, is composed of two cells which are placed in a heavy hard-rubber composition container. While the electrolyte is suitably vented, nevertheless it is claimed that even turning the battery upside down and shaking it violently will not permit so much as a drop to escape. The cells, which each have two positive and three negative plates and a rated capacity of 6 amp., have electrical connections to the cap-lamp cable in the upper position of the battery case. Though this part may be separated from the lower portion, its removal requires the use of a special key spanner. Being attached to the miner's belt at two widely separated points, the weight is evenly distributed.

A feature of the cap lamp is that the hemispherical reflector which spreads light rays over a 7-ft. (2.1-m.) circle at a distance of 20 ft. (12 m.) contains not one bulb but two. These are not both used at the same time, but a special switch allows using either of them so that should the filament of one burn out or the bulb be fractured, the current can be immediately switched on to the other lamp, thus eliminating any possibility of the miner being left in darkness. Should breakage occur, two springs which clamp the base of each bulb in position flip the bulb or its remains out of place and break the electrical contact. This is a safety advantage of no small importance.

The light strength of the lamp is 22 lumens, and the lamp and battery rating is twelve hours' continuous burning when a 4-volt, 0.5-amp. bulb is used. It is said that distilled water need be added to the electrolyte only about once in two weeks. In order to prevent unauthorized tampering with the battery the case is sealed with a small lead seal bearing the lamp inspector's mark and which, though readily cut to provide access to the battery, can be replaced only by him. Another feature pointed out is that the battery can be easily and safely used for firing mine shots.

### Compact Unit-Type Automatic Refrigerators

Especially compact automatic refrigerating machines for refrigeration in hotels, stores, factories, large residences, etc., are being marketed by the Peerless Ice Machine Company, 120 Broadway, New York City. These elec-

SINGLE-CYLINDER AUTOMATIC REFRIGERATION MACHINE

trically driven machines, which are supplied in single and double cylinder sizes, consist of a compressor, oil trap, condenser coils, ammonia receiver and electric motor, all assembled on one base. Because of this arrangement, the makers claim, the large space required, the multiplicity of parts and the numerous starting and stopping operations which characterize many such machines are improved upon.

In the smaller size the motor is mounted on top of the water jacket to conserve space and insure proper alignment, while in the double-cylinder type the motor is placed alongside the refrigerating machinery. Chain-belt drive is utilized in both cases to connect the motor to the flywheel of the compressor. Thermostatic control being used, it is said that the machines require no attention except an occasional oiling.

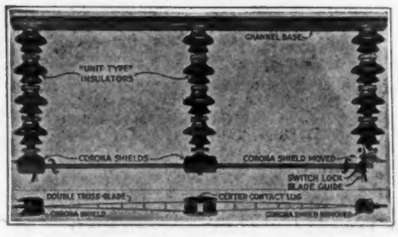
### Panelboard Switches

The new panelboard push switch recently produced by the Hart & Hegeman Manufacturing Company, Hartford, Conn., features an unbreakable metal base which does away with breakage expense and inconvenience since no porcelain is used in constructing the switch. The switch mechanism is held in alignment by the base, this being separated from the contact plates by heavy strips of a special insulating composition said to be both unbreakable and unburnable. Because of the contact plates having forks instead of holes for the screws it is pointed out that considerable time and trouble are saved when inserting the screws for fastening the switches to the busbars. The switch cover is of black composition material mounting a card holder for indicating the circuit control.

The spacing of the holding screws on these new switches is 1¼ in. (3.8 cm.) on centers each way to meet the standard spacing used by panelboard manufacturers. These spacings are also used in a panelboard switch of the rotary type made by this company.

### 110,000-Volt Selector Disconnecting Switches

For application to 110,000-volt systems a selector transfer disconnecting switch of the unit type is being manufactured by the Delta-Star Electric




UNIT INSULATORS ARE EASILY REPLACED

Company, 2433 Fulton Street, Chicago. Because the insulating pillars are built up in unit sections, any of them can be easily replaced in case of breakage. The blades are of double-truss form and provided with guides and safety locks, which are equipped with corona shields.

## Trade Notes

LITTLE PROSPECT OF LABOR SHORTAGE.—In a recent address on labor conditions Nathan A. Smyth, assistant director-general of the United States Employment Service, made the following remarks about the labor supply: "We have to-day a deficit of more than 2,281,000 workingmen. In addition, we must contemplate that an average of about a million men will remain in our army for about a year. About half a million will stay in our newly built shipyards. On the other hand, we have discovered in many places an indication of a widespread purpose among Europeans in this country to go back to the country of their origin as soon as they can. An abnormally high emigration is in sight. Any great inflow of immigrants during the next year does not seem likely. Where is there, then, any possibility of a surplus of labor and reduced wages, unless our industries are palsied and fail to respond with vigor to the unprecedented opportunities which await us?"

IMPORT RESTRICTIONS ON RUBBER LIFTED.—The War Trade Board announces, in a new ruling (W. T. B. R. 414), that all restrictions upon the quantity of crude rubber which may be imported from overseas have been removed. Applications for licenses to import this commodity will now be considered without limit as to quantity. It is also announced that the War Trade Board withdraws the government option price and will require no further undertaking relative to maximum values. Careful consideration has been given to the advisability of eliminating the requirement of guarantees, but it has been found necessary to require these undertakings for the present. This relaxation, however, will not authorize the importation of any shipments of rubber from any country other than the country of origin. Applications for import licenses for such shipments will not be considered until after Feb. 13, 1919. The same policy will be applied to applications for licenses to import shipments of rubber now in the United States which have been made in violation of the regulations.

A FURTHER AID TO AMERICAN INTERESTS IN FOREIGN TRADE.—The Bureau of Foreign and Domestic Commerce is organizing a special statistical-service section for the purpose of furnishing regular monthly tabulations of imports and exports in more detail than is contained in the monthly summary of foreign commerce of the United States. For example, where the monthly summary shows only the total exports of electric lamps, motors and other classes of electrical machinery and appliances, the new service section proposes to make compilations showing the various countries to which shipped. Statements will also be furnished showing details of imports by countries not included in the monthly summary. The demand for more detailed statistics of imports and exports than is possible to show in the publications is unusually heavy at this time, when American manufacturers are preparing to extend the sales of their products in the foreign markets of the world, and it is the aim of the bureau to expand this special service as far as the facilities at its disposal will permit. Trade organizations, trade papers and commercial firms are invited to submit requests for special statistical information, also to make suggestions for the extension of this service.

WESTERN ELECTRIC'S PLAN FOR ABSORBING FORMER EMPLOYEES NOW IN MILITARY SERVICE.—Following is an authorized statement of the plan of the Western Electric Company for reassignment to work of its former employees who are now in the military service: "Former employees who have been given a leave of absence for military service and who have been honorably discharged therefrom, and who desire to again take up work in the company, should make application within thirty days after being mustered out of service. If possible, they will be promptly assigned to work for which their previous experience qualified them, at the rate of pay which others are then being paid for similar work. If it is not possible to assign them to work immediately, they will be placed on a preferred list until such time as business conditions enable the company to place them. During their continuance on this preferred list they will enjoy the same rights with respect to the employees' benefit plan as they had while in the service of the United States, and they may take other employment. When they are notified of a vacancy they should present themselves for work at the time stated, and failing to present themselves for ten days thereafter their leave of absence shall terminate. Before assignment to any work their suitable physical condition for such work must be determined in accordance with the regular routine."

THE FARIES MANUFACTURING COMPANY, Decatur, Ill., has recently equipped the United States government arsenal at Rock Island, Ill., with 825 of its new patented adjustable electric brackets.

J. M. LYON, formerly city sales manager of the Manhattan Electric Supply Company, 17 Park Place, New York, resigned on Dec. 18. On that date the general sales and city sales departments of the Manhattan Electric Supply Company were consolidated, and they are now operated under the direction of K. S. Byrd as sales manager.

THE MILLIKEN BROTHERS MANUFACTURING COMPANY, INC., New York, is now stocking up at its new plant, 136th Street and the East River, preparatory to the installation of machinery and equipment to provide for the production of its various specialties, including electric transmission towers, steel poles, etc. The galvanizing plant will be erected on an adjoining plot.

THE SOLAR ELECTRIC COMPANY, 124-26 West Lake Street, Chicago, announces that it has purchased the entire Flasher business, good will and interest of the Phelps Manufacturing Company of Detroit, and from now on will be the sole manufacturer and distributor of the Phelps motorless flashers, which have been greatly improved. These flashers will be added to the company's line of solar canteen globes for electric advertising signs, special outdoor brackets and weatherproof shade holders.

H. W. CLARKE, who until Dec. 15 had been connected with the advertising service department of the McGraw-Hill Company at Chicago, has been appointed manager of advertising for the Chicago (Ill.) Pneumatic Tool Company. Mr. Clarke has been identified with the engineering advertising field for several years. Prior to his connection with the McGraw-Hill publications he spent eight years with the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., part of the time as a member of the sales and publicity departments and later as Western publicity representative with headquarters at Chicago.

THE FLETCHER ELECTRIC SUPPLY COMPANY, 15 West Seventeenth Street, New York City, has been purchased by Daniel C. Keefe, John M. Lyon and James D. Mills. The new firm was incorporated this month under the name of the Fletcher Supply Company and will occupy the same premises. Mr. Keefe, the president of the new company, and Mr. Lyon, the secretary, were formerly connected for about twenty years with the Manhattan Electric Supply Company, New York City. Mr. Mills, the treasurer of the new concern, was an associate of Mr. Fletcher, whose death was reported in the ELECTRICAL WORLD for Dec. 14. The Fletcher Supply Company will, as formerly, carry on a general electrical supply jobbing business.

## Trade Publications

FACTORY BUILDINGS.—A booklet recently issued by the Austin Company of Cleveland has for its subject Austin standard wooden factory buildings.

ELECTRICAL SUPPLIES.—The Canton Engineering & Electric Company of Canton, Ohio, has prepared catalog No. 18, a 606-page publication dealing with electrical supplies.

WATER PUMPS.—Bulletin No. 4094, describing self-priming pumps and water systems for shallow wells, is being distributed by the Fort Wayne Engineering & Manufacturing Company of Fort Wayne, Ind.

POLISHING AND BUFFING LATHE.—Bulletin No. 28 from the Webster & Perks Tool Company, Springfield, Ohio, contains specifications and an illustration of the No. 15 electrically driven polishing and buffing lathe.

SOCKET.—The R-K socket marketed by the R-K Socket Company of Mineral Wells, Tex., is the topic of a folder from this company.

TROUBLE LOCATER.—Paul G. Niehoff & Company, 232 East Ohio Street, Chicago, describe their "Defectometer" in a recently issued folder.

VIBRATOR.—The "Star" vibrator for massaging is the subject of a new sixteen-page booklet of the Fitzgerald Manufacturing Company, Torrington, Conn.

VACUUM CLEANER.—A new folder about the "Thor" vacuum cleaner has been prepared by the Hurley Machine Company, 28 East Jackson Boulevard, Chicago.

WALL-BRACKET FIXTURE.—A folder having for its subject the new "Fifty-Fifty" wall bracket lighting fixture is being distributed by the Lightolier Company, 569 Broadway, New York City.

MOTORS.—Type "H" steel-frame direct-current motors and type "N" squirrel-cage alternating-current motors, which have identical dimensions in the same horsepower capacities, are described and illustrated in a folder published by the B. A. Wesche Electric Company of Cincinnati, Ohio, whose Eastern sales agent is the National Electric & Welding Company, 90 West Street, New York City.

LIGHTING.—The December issue of "Eye Comfort," the National X-Ray Reflector Company's publication, "to aid advocates of good lighting," issued from the company's main offices, 235 West Boulevard, Chicago, contains news of interest to dealers, pages on the Curtis portable adapter, showcase reflectors, floodlighting units and samples of advertisements in trade papers and dealers' literature.

DISH CONVEYOR.—Samuel Olson & Company, 2418 Bloomingdale Avenue, Chicago, have issued a twenty-two-page booklet telling about their "Subveyor," which is an automatic device for use in hotels and restaurants to carry soiled dishes to the dish-washing department and to return clean dishes to floors above. Installations of these elevators in various hotels and restaurants are shown, together with a number of testimonials.

## New Incorporations

THE TOLINER ELECTRIC COMPANY of Brooklyn, N. Y., has been incorporated with a capital stock of $15,000, by J. D. Christie, D. W. von Bremen and J. D. Miller, 215 Montague Street, Brooklyn.

THE TIDEWATER TIRE & ELECTRIC CORPORATION of Norfolk, Va., has been chartered with a capital stock of $25,000 by J. W. H. Greene and Seemes Chapman. The company proposes to manufacture tires and other specialties.

THE ELECTRIC BRAZING & WELDING MACHINE COMPANY of New York, N. Y., has been incorporated by A. M. Sheard, J. M. Vincent and E. M. Simon, 1228 Halsey Street, Brooklyn, N. Y. The company is capitalized at $5,000.

THE SELSON ENGINEERING COMPANY of New York, N. Y., has been incorporated by O. Ruprecht, F. W. Wearin and G. Kohn, 24 Stone Street, New York, N. Y. The company is capitalized at $5,000 and proposes to deal in machinery and electrical equipment.

THE FAIRFIELD (ALA.) UTILITIES COMPANY has been organized with a capital stock of $50,000 for the purpose of operating electric and gas plants and street railway lines in Fairfield. George Gordon Crawford is president, N. C. Ryding vice president, and L. T. Beecher secretary and treasurer.

THE NEW YORK INSULATION COMPANY of Brooklyn, N. Y., has been incorporated by J. J. M. and J. Sullivan, 482 Tompkins Avenue, Brooklyn. The company is capitalized at $10,000, and proposes to manufacture machinery for the production of flange joints, asbestos specialties for insulation, etc.

THE SIMPLEX CLOTH CUTTING MACHINE COMPANY of New York, N. Y., has been chartered with a capital stock of $50,000 to manufacture electrical cloth-cutting machines. The incorporators are: M. Zawistowski, 422 East Third Street, Brooklyn, N. Y.; M. Finkelstein, 1153 Longfellow Avenue, and N. Obedin, 1145 Longfellow Avenue, the Bronx

## New England States

CAMBRIDGE, MASS. — Contract has been awarded by the Lever Brothers Company, 176 Broadway, for addition to its factory, to the Stone & Webster Company, 147 Milk Street, Boston. The cost is estimated at $500,000.

NEW BEDFORD, MASS.—Work has begun on the erection of a new transformer station at the plant of the Whitman Mill Corporation.

WEST DUDLEY, MASS.—The Burmus Paper Company is contemplating the construction of power house and dam, to cost about $50,000.

## Middle Atlantic States

ALBANY, N. Y.—Bids will be received at the office of W. W. Wotherspoon, Superintendent of Public Works, Capitol, Albany, until Jan. 14, for furnishing and installing under terminal contract No. 102, two 3-ton electric semi-portal revolving jib cranes on Pier 6, East River, New York City. Plans may be seen and other information obtained at the above office, at the office of the assistant superintendent of public works for the Middle Division at Syracuse, N. Y., at the office of the assistant superintendent of the Western Division at Rochester, N. Y., and at the canal office, Spaulding's Exchange, Buffalo, N. Y.

BINGHAMTON, N. Y.—The Binghamton Light, Heat & Power Company has been awarded a contract for lighting the streets and public buildings in Binghamton for a period of five years, at a minimum rate of $7,000 per year.

BROOKLYN, N. Y.—The stockholders of the Kings County Electric Light & Power Company have approved the proposition to change the name of the company to the Brooklyn Edison Company. The Edison Electric Illuminating Company of Brooklyn, the operating company controlled by the Kings County company, will be merged into the new company. The resolution passed by the directors to create a blanket mortgage, which is not to exceed $11,000,000 at any time, has also been approved. The company has asked the Public Service Commission for permission to issue $6,000,000 of bonds, the proceeds to be used to pay off outstanding indebtedness amounting to $4,000,000 for extensions and improvements already made to the property. Further improvements are contemplated with part of the balance.

BUFFALO, N. Y.—The Marine Elevator Company, Chamber of Commerce Building, is reported to be considering plans for the construction of a new grain elevator on Buffalo River, to cost from $500,000 to $1,000,000.

NEW YORK, N. Y.—Steps have been taken by the Broadway Association for improvements to the street-lighting system.

NEW YORK, N. Y.—The contract for underground conduit work at the plant of the Pouch Terminal Company, Clifton, Staten Island, has been awarded to the Barney-Ahlers Construction Company, 110 West Fortieth Street, New York City.

NEW YORK, N. Y.—Plans are being prepared for the erection of a new hospital by the Diagnosis Clinics of the Academy of Diagnosis at 125 West Seventy-second Street, to cost about $250,000. Considerable electrical equipment and appliances will be installed.

NIAGARA FALLS, N. Y.—The Public Service Commission has granted the Niagara Falls Power Company permission to issue $2,000,000 in bonds, under a mortgage executed by the Hydraulic Power Company, the proceeds to be used for extensions and improvements. The company proposes to build an addition to power house No. 3 and install new electric generating and hydraulic machinery.

TROY, N. Y.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Jan. 14, for additional conduit and wiring and lighting fixtures in the United States post office, courthouse building, etc., at Troy, N. Y. For details see Searchlight Section.

UTICA, N. Y.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Jan. 14, for extensions to conduit and wiring, lighting fixtures, etc., in the United States post office, custom house and court house, Utica, N. Y. For details see Searchlight Section.

JERSEY CITY, N. J.—Bids will be received by the Boulevard Commissioners, Court House, Jersey City, until Jan. 3, for 100,000 ft. of copper-coated round carbons, ½ in. by 12 in. John J. O'Connor is acting clerk.

# *Construction*

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

CARLISLE, PA.—Plans are under consideration by E. C. Beetam & Son for the erection of a power plant, 50 ft. by 70 ft., at their carpet manufacturing plant, to cost about $50,000.

FORTY FORT, PA.—Plans have been prepared by the International Fabricating Corporation of Wilkes-Barre for the construction of an addition to its works, 50 ft. by 160 ft., at Forty Fort, to cost about $60,000.

HARRISBURG, PA. — Application has been made to the Public Service Commission by various utility companies for permission to issue additional capital stock or bonds as follows: The Philadelphia Electric Company, $1,500,000 in bonds; the Metropolitan Edison Company of Reading, $119,000; the Mahoning & Shenango Railway & Light Company of New Castle, $550,000 in bonds; the Citizens' Light & Power Company of Oil City, $51,000 in bonds; the Citizens' Traction Company of Oil City, $43,000 in bonds; the Christiana & Coatesville Street Railway Company of Lancaster, $35,000 in stock, and the East Pennsylvania Gas & Electric Company of Scranton, $100,000 in capital stock.

PHILADELPHIA, PA. — Specifications recently issued by the Pennsylvania Railroad Company for cranes include one 5-ton, 28-ft.-lift, 44-ft.-span electric gantry crane for ash-pit service; one 10-ton, three-motor, 20-ft.-lift, 60-ft.-span overhead traveling crane; one 5-ton, three-motor, 20-ft., 28-ft. span crane, and one 5-ton, three-motor, 29-ft.-lift, 59½-ft.-span crane.

PITTSBURGH, PA.—Plans have been filed by the Carbon Steel Company of Pittsburgh for the erection of a machine shop and mill, one story, to cost about $89,300, and mill building, to cost $41,500. Arrangements are also being made by the company for construction of a third mill building, to cost about $31,300.

CHARLESTON, W. VA.—The Kanawha Collieries Company, National Bank Building, is planning to install additional power-plant equipment.

CHARLESTON, W. VA.—Improvements are contemplated by the Snow Hill Coal Company to its properties, including the installation of electrical machinery. W. T. George of Phillippi is president.

ELKINS, W. VA.—Plans are under consideration by the Elkins Box Company for rebuilding its plant, recently destroyed by fire. The loss is estimated at $150,000.

GILMERTON, VA.—The Virginian Railway Company is planning to install automatic block signals on its railway between Gilmerton and Sewall's Point, a distance of 12 miles. The plans call for two electric interlockings plants and one interlocking plant with power signals. H. Fernstrom of Norfolk is chief engineer.

NORFOLK, VA.—The Norfolk-Hampton Roads Dry Dock & Ship Repair Corporation, recently organized with a capital stock of $7,000,000, is reported to have purchased a site in this vicinity for its proposed plant. The buildings will include machine shops, foundry, general construction and repair shops as well as a large drydock of 15,000 tons capacity. A second drydock of the same capacity is also contemplated. J. B. Morgan is president and O. B. Woodridge is secretary and treasurer.

HAMPTON ROADS, VA.—The Port and Harbor Facilities Commission of Washington, D. C., is considering the installation of eleven coal-handling or bunkering machines, each with a capacity of 75 tons, at Hampton Roads.

WASHINGTON, D. C.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Dec. 30, under Specification 3632, for construction of addition to the power plant at the navy yard at New York, to cost about $175,000.

WASHINGTON, D. C.—The construction of a new power plant at the naval magazine work, New York Harbor, to cost about $150,000, is under consideration by the Bureau of Yards and Docks, Navy Department. Plans are also being prepared by the Bureau of Yards and Docks for the erection of a naval aircraft station, with aëroplane shop and construction buildings on Long Island, N. Y., to cost about $800,000.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., for furnishing at the various navy yards and naval stations supplies as follows: Eastern and Western yards, until Jan. 7, Schedule 3567—miscellaneous dry cells; Schedule 3572—miscellaneous insulating tape. Bids will also be received in the near future for the following: Eastern and Western yards, Schedule 3591—steel sockets. Philadelphia, Schedule 7526½—six single-phase transformers; Schedule 7544½—50 signaling searchlights; Schedule 7550½—15 gasoline generator sets, f.o.b. works; Schedule 7533½—miscellaneous gas engines and spares. Brooklyn, Schedule 7538½—lead-covered wire. Mare Island, Schedule 7555½—13,000 ft. conduit pipe and miscellaneous steel pipe. Puget Sound, Schedule 7583½—15,000 ft. incandescent lamp cord and a miscellaneous quantity of single-conductor wire. Applications for proposal blanks should designate the schedule by number.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., for furnishing at the various navy yards and naval stations supplies as follows: Various, Schedule 3579—miscellaneous direct-current ammeters; miscellaneous fuse blocks, miscellaneous fuse terminal clips and blocks, carbon plate, 12 in. by 12 in., miscellaneous ferrule contact fuse clips, miscellaneous 4-amp. glass-tube fuses, link fuses, magneto testing generators, miscellaneous portable ventilating sets, miscellaneous back-connected knife switches; Schedule 3581—miscellaneous vibrating bells, portable firing salvo buzzers, watertight buzzers; Schedule 3585—540 repectacle caps, miscellaneous arc-lamp carbons, unglazed porcelain cleats, combination plug and switch cut-outs, plug-type inclosed fuses, shade holders, porcelain knobs, Edison base attachment plugs, fuseless cleat rosettes, incandescent lamp, sockets, indicating snap switches; Schedule 3577—round-rod white horn fiber, hard insulating fiber, yellow oiled insulating muslin, copper-covered insulated staples, varnished-cambric insulating tape, varnished silk taps, copper cable terminals. Schedule 3580—miscellaneous non-water-tight portable guards, desk-type electric heaters, electric soldering irons, lanterns, steel angle reflectors, telephone testing sets. Puget Sound, Wash., Schedule 3578—100 portable tube blinkers. Norfolk, Va., Schedule 3548—miscellaneous plain double-conductor telephone cord; Schedule 3578—searchlight mirrors. Charleston, S. C., Schedule 3585—wall-type receptacles. Philadelphia, Pa., Schedule 3585—1000 Hubbell receptacles or bases, miscellaneous reflectors, key and keyless brass sockets, porcelain base entrance switches, push-button switches; Schedule 3577—1000 rolls oiled muslin tape. Boston, Mass. Schedule 3580, 4000 rubber illuminating set socket rings. Eastern and Western navy yards. Schedule 3548—miscellaneous bell cord telephone cable, lighting and power and bell wire; Schedule 3551—miscellaneous hard-dawn copper; Schedule 3577—hard-rubber tubing, hard-rubber rod, insulating muslin, insulating fiber cable terminals, insulating fish paper, asbestos sleeving, insulated staples, insulating tape, silk and muslin, soldering paste and white horn fiber; Schedule 3578—searchlight strips, storage-battery testing outfits, searchlight mirrors, lantern lenses and 100 portable blinkers; Schedule 3579—knife switches, fuse blocks, two blink fuses, ventilating sets, ferrule fuse clips, plate carbon, blocks and clips, direct-current ammeters and testing generators; Schedule 3580—lanterns, soldering and flat, telephone testing sets, 4000 socket rings, steel reflectors, electric heaters and portable guards; Schedule 3581—vibrating bells and watertight buzzers; Schedule 3585—540 receptacle caps, miscellaneous arc-lamp carbons, porcelain cleats, combination cut-outs, shade holders, porcelain knobs, attachment plugs, 1200 wall-tight receptacles, 1000 receptacles in bases, miscellaneous reflectors, cleat rosettes, brass sockets, push-button entrance switches, indicating snaps, porcelain tubes, inclosed fuses, miscellaneous incandescent-lamp sockets and snap switches. Washington, Schedule 7440½—miscellaneous buzzer instruction sets. Norfolk, Schedule 7451½—miscellaneous motor-generators. Alexandria, Va., Schedule 7464½—two 3-ton cranes. Brooklyn, Schedule 7465½—30,000 ft. interior cable; Schedule 7488½—1000 porcelain insulators. Boston, Schedule 7466½—3,950,000 ft. antenna wire. Boston, Norfolk, and Mare Island, Schedule 7475½—searchlight carbons. Philadelphia, Schedule 7492½—2000 spools of copper wire. Applications for proposal blanks should designate the schedule desired by number.

WASHINGTON, D. C.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., for furnishing at the various navy yards and naval stations supplies as follows: Newport, Specification 3250—widening and lighting slips. Hampton Roads, Specification 3300—coal-handling machinery; Specification 3328—mechanical equipment; Specification 3645—automatic telephone extension. Pensacola, Fla., Specification 3389—power-plant improvements. Boston, Mass., Specification 3477—electric traveling crane for extension to machine shop and foundry building No. 2. Mare Island, Specification 3561—electric storehouse, bids to be opened at the yard. Brooklyn, N. Y., Specification 3599—elevator and dumb-waiter in building D. Montauk, L. I., Specification 3615—siren fire-alarm system, bids to be opened at the yard. Bay Shore, L. I., Specification 3616—siren fire-alarm system, bids to be opened at the yard. New York, Specification 3632—extension to power plant; Specification 3679—electric freight elevator; Specification 3680—electric crane for shipbuilding slip No. 2. New Orleans, La., Specification 3635—electric freight elevator. Bellevue, D. C., Specification 3640—electric traveling crane. Bay Ridge, N. Y., Specification 3695—fire-alarm system. Indian Head, Specification 3710—electric gantry crane. Rockaway, N. Y., Specification 3711—underground electric distributing system. Application for proposal blanks should designate the schedule desired by number.

## North Central States

MARQUETTE, MICH.—The Cleveland-Cliffs Iron Works of Cleveland is contemplating the construction of a new hydro-electric power plant in connection with its properties in this vicinity.

AKRON, OHIO.—The B. F. Goodrich Company, Cherry and Canal Streets, has engaged Griggs & Meyers, engineers, 110 West Fortieth Street, New York, N. Y., to prepare plans for alterations to power plant, including the installation of new equipment, etc., to cost about $750,000.

GALESBURG, ILL.—Bids will be received by William L. Boutelle, city clerk, Galesburg, until Jan. 2, for a deep-well pumping unit. Further information may be obtained at the office of F. M. Connolly, city engineer.

JOLIET, ILL.—The local power house of the Public Service Company of Northern Illinois is reported to have been destroyed by fire recently.

NEENAH, WIS.—The Hewitt Machine Company of Neenah has acquired the Jamieson water-power property and, it is understood, will develop it further to supply power for the Hewitt plant.

RACINE, WIS.—Preparations are being made by the Perfex Radiator Company for the construction of a new plant at Eighteenth Street and Flett Avenue, to cost about $100,000. Contracts, it is reported, will be awarded immediately after Jan. 1. The company manufactures automobile, truck and tractor radiators and cooling systems.

WEST ALLIS, WIS.—Bids will soon be taken by Robert A. Messmer & Brother, Majestic Building, Milwaukee, architects, for the construction of a new high school building in West Allis. The building will cost about $280,000, and will contain an auditorium, swimming pool, gymnasium and manual training department.

WEGDAHL, MINN.—The farmers in the vicinity of Wegdahl have petitioned the Northern States Power Co. of Montevideo to furnish electrical service. They have offered to pay the cost if necessary.

ST. LOUIS, MO.—The War Department has issued orders for abandonment of work on construction of the ammunition plants of the Laclede Gas Light Company, at Broadway and Manchester Street.

SUMNER, MO.—The Sumner Electric Company, it is reported, contemplates the erection of a 12-mile electric transmission line next summer. The company is now building a line to Forker, a distance of 12 miles. A. Stobaugh is manager.

HILLSBORO, KAN.—Plans are being prepared for the erection of a college building at Tabor College, to cost about $100,000, for which bids will be asked about the middle of January. Heating, electric wiring and plumbing work has been postponed until spring.

PRATT, KAN.—Bids will be received by the Board of Education of Pratt until Jan. 6 (extension of date from Dec. 19) for construction of high-school building, including heating, electric wiring, fan ventilating, etc. The cost of the building is estimated at $175,000.

## Southern States

CHARLESTON, S. C.—The contract for electric wiring of the Young Women's Association Building has been awarded to the Electric Supply Company of Charleston. The cost of the building is estimated at $91,000.

BUNNELL, FLA.—Contract has been awarded by the City Council to Fairbanks, Morse & Company of Atlanta, Ga., for the installation of an alternating-current street-lighting system to replace the present direct-current system.

CRESCENT CITY, FLA.—Fairbanks, Morse & Company of Atlanta, Ga., have been awarded contract by the City Council for the installation of a complete electric light plant, to include pole transformers. The cost is estimated at $12,000.

LITTLE ROCK, ARK.—The Little Rock Railway & Electric Company, it is understood, has purchased a 5000-kw. turbine for its power plant. C. J. Griffith is general manager.

KURTHWOOD, LA.—The Vernon Parish Lumber Company is planning to begin construction work in January on its proposed lumber plant to develop about 1700 acres of timber land, which will include saw and planing mills, single cutting band-saws for timbers, steam dry kilns, etc. The development of a townsite is also included in the project. The company is capitalized at $600,000. J. H. Kurthwood, Jr., of Kurthwood, is president and general manager. Post office address, Pawnee, La.

COVINGTON, OKLA.—Plans are under consideration by City Council for the installation of electric plant, waterworks and sewer systems in Covington. An election will probably be called soon to vote on an issue of $40,000 in bonds for the proposed work.

POTEAU, OKLA.—Bids will be received at the office of the city clerk, Poteau, until Jan. 31, 1919, for construction of waterworks system and filter plant, consisting of one pumping station, one filter house, one sedimentation basin, one pure-water reservoir, two 100-hp. boilers, two high-service pumping engines, three steam engines or turbine-driven centrifugal pumping units, two duplex boiler-feed pumps, steam and water piping, filter equipment for two tanks, one concrete overfall dam, 3½ miles of cast-iron pipe, valves and hydrants. Plans and specifications are on file at the office of the city clerk, Poteau, or may be obtained from J. E. Davis, engineer, Poteau, upon deposit of $10.

PROWNWOOD, TEX.—The construction of an irrigation system, including the construction of a dam across Canadian River and installing pumping plants to irrigate several thousand acres, is being promoted by the Dickerson-Tanner-Whaley Company.

DALLAS, TEX.—Plans are under consideration by the Dallas Motor Car Company for rebuilding its plant, recently destroyed by fire. The loss is estimated at about $150,000.

DALLAS, TEX.—Permission has been granted the Dallas Power & Light Company to purchase the property of the Carroll Electric Company, which operates a small local plant.

GALVESTON, TEX.—Bids will be received by the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Dec. 30, for erection of shops and industrial building. The cost is estimated at $270,000.

## Pacific and Mountain States

FOSSIL, ORE.—Steps have been taken by local business men for the installation of an electric lighting plant at Fossil. An option has been taken on the mill property and old light plant of J. A. Miller. A new 75-hp. engine will be purchased to replace the old steam engine.

ALAMEDA, CAL.—Application has been made by the Alameda Sugar Company and the Alameda Farms Company to the State Water Commission for permission to appropriate water from the Sacramento River in Sutter County for the irrigation of 7600 acres of land. It is proposed to install pumping plants at three different places and to connect the three plants. The cost of the work is estimated at $287,000.

BRANDY CITY, CAL.—The Brandy City Mining Company is contemplating the construction of a large dam on the North Yuba River, below Bullard's Bar. The proposed dam will be 150 ft. high and will back up water for a distance of several miles. A large power plant will be erected near the dam to supply electricity to operate the machinery in the mines.

FRESNO, CAL.—Surveys are being made in the mountains for the San Joaquin Light & Power Company with a view of preparing for after-war activity.

FRESNO, CAL.—The Pacific Gas & Electric Company of San Francisco is planning to erect a new forge and blacksmith shop at its local gas works, recently completed. A new pump house will also be built.

LOS ANGELES, CAL.—Arrangements have been made by the Water Department for an appropriation of $500,000 for extensions and improvements to the municipal water system. The proposed plans provide for the installation of two electrically operated pumping plants at the city stations; the completion of the Haiwee power plant at the Haiwee reservoir, to consist of a hydroelectric generating station, to cost $65,000; construction work at the San Fernando and Charsworth reservoirs, to cost about $140,000, and other extensions. William Mulholland is chief engineer.

PALO, ALTO., CAL.—The Board of Public Works has instructed the city engineer to proceed with the work of installing street lamps in South Palo Alto.

RIVERSIDE, CAL.—Plans are under consideration by the Southern Sierras Power Company of Riverside for extensions to its various hydroelectric plant at Birch Creek, Inyo Canyon, to cost about $85,000. The company operates five generating stations in this locality.

SAN FRANCISCO, CAL.—The Pitt River Power Company of San Francisco, recently incorporated with a capital stock of $2,500,000, has acquired rights on the Pitt River below the Big Bend, or the Pacific Gas & Electric Company's site, and is now making surveys and soundings. The proposed plans include the construction of two multiple-arch dams across the river about 12 miles apart, each 200 ft. high. The first dam will be located about a mile above Sheep Rocks at a site reported on in 1914 by the United States Reclamation Service. The power house will be built inside the dam and will be equipped with two 16,000-kw. generators. Generating units of the same rating are to be installed later at the other site, making the total development 64,000 kw. The use to which the power will be put has not yet been announced.

FLORENCE, ARIZ.—Plans are under consideration by the City Council for improvements to the waterworks and lighting systems, to cost about $80,000.

JULESBURG, COL.—Bonds to the amount of $100,000 have been sold for the installation of a municipal electric light plant. Bids, it is understood, will soon be asked for construction of same. The Henningson Engineering Company, 1122 Farnam Street, Omaha, Neb., is engineer.

## Canada

VICTORIA, B. C.—Work, it is understood, will soon be started on the construction of shipyards and machine shop for the Victoria Machinery Depot, 343 Bay Street, Victoria, to cost about $350,000.

HALIFAX, N. S.—Contract has been awarded to the Bedford Construction Company of Halifax for the construction of a new power house for the Halifax Shipyards, Ltd., Barrington Street, to cost about $60,000.

ALVINSTON, ONT.—The Town Council is considering the purchase of the plant of the Alvinston Power Company. If taken over by the municipality, improvements will be made to the system.

SHAWINIGAN FALLS, QUE.—The plant of the Canadian Electric Products, Ltd., on Transmission Avenue, was recently destroyed by fire, causing a loss of about $150,000.

## Miscellaneous

PANAMA.—Bids will be received at the office of the general purchasing officer of the Panama Canal, Washington, D. C., until Jan. 13, for furnishing steel, pipe, bronze, steel cable, copper wire, monel metal solder etc. Blanks and further information relating to this circular (1248) may be obtained at the above office or the offices of the assistant purchasing agents, 24 State Street, New York City; 606 Common Street, New Orleans, La., and Fort Mason, San Francisco, Cal.

(Issued Nov. 19, 1918)

1,284,982. PROCESS AND APPARATUS FOR PRODUCING AND STIMULATING RAINFALL; John G. Balsillie, Melbourne, Victoria, Australia. App. filed Dec. 23, 1916. The potential gradient between earth and atmospheric zones and clouds is diminished or canceled, producing or stimulating rainfall.

1,284,996. SEMI-AUTOMATIC TELEPHONE-EXCHANGE SYSTEM; Frank R. McBerry, Antwerp, Belgium. App. filed Sept. 13, 1912. The extension of the desired connection from a calling line to a called line is accomplished by automatic selector switches under the control of an operator at the central or switching station.

1,285,006. SECTION INSULATOR; Glenn H. Bolus, Mansfield, Ohio. App. filed Dec. 20, 1917. For dividing the overhead conductor or trolley wire of an electric railway into sections and insulating the sections one from the other.

1,285,012. ELECTRIC CONDUCTING CABLE OR WIRE; Carl P. Brodhun, Wilkes-Barre, Pa. App. filed April 16, 1917. To make it impossible for the insulating material to slip or work loose.

1,285,013. ELECTRIC HEATER FOR AUTOMOBILE RADIATORS; Jewell D. Browder, Jr., Canadian, Okla. App. filed Dec. 20, 1917. Also prevents water from freezing in elevated water tanks.

1,285,049. MACHINE RECORDER; Peter A. Cooney, Chicago, Ill. App. filed Oct. 5, 1910. For indicating amount of time during which machines in a factory are occupied in productive work and the time they are idle.

1,285,052. ELECTRIC TRAFFIC INDICATOR; Thomas W. Crisman and Alexander G. Brehm, Hastings, Neb. App. filed April 27, 1917. Signal is given both by signal lights and by a movable indicating member.

1,285,054. ELECTRIC BATTERY; Harry F. French and Raymond C. Benner, Fremont, Ohio. App. filed June 6, 1916. Consists of copper oxide and zinc electrodes and an electrolyte containing hydroxides of sodium and ammonium.

1,285,070. SYSTEM OF CONTROL; John V. Dobson, Wilkinsburg, Pa. App. filed July 22, 1915. To be employed in connection with alternating-current motors of the compensated commutator type.

1,285,072. PUSH-BUTTON SNAP SWITCH; Harry A. Douglas, Bronson, Mich. App. filed April 4, 1917. Aims at simplified construction.

1,285,098. MEANS FOR DISPLAYING ILLUMINATED WORDS OR CHARACTERS; John R. Flannery and Ethan L. Dodds, Pittsburgh, Pa. App. filed Oct. 5, 1917. Illuminated words or characters caused to appear in the dark and maintain their luminosity for an appreciable length of time without necessity for the employment of electrically controlled switch devices.

1,285,138. FLEXIBLE ELECTRICAL CONDUIT; Hans Hansen, Brooklyn, N. Y. App. filed March 9, 1916. Non-metallic yet non-collapsible and non-extensible, and having a smooth interior surface.

1,285,145. INDICATOR; Fred H. Harrington and Stephen E. Buck, Moline, Ill. App. filed July 26, 1917. For indicating the amount of liquid contained in receptacle.

1,285,160. MOTOR-CONTROL SYSTEM; Rudolf E. Hellmund, Pittsburgh, Pa. App. filed June 11, 1915. For single-phase alternating-current motors of the compensated doubly fed type.

1,285,161. SYSTEM OF CONTROL; Rudolf E. Hellmund, Pittsburgh, Pa. App. filed Sept. 9, 1915. Relates to phase-advancing means for regulating the power factors of polyphase induction motors and distributing systems.

1,285,167. ELECTRIC STARTER; William T. Hensley, Bound Brook, and Charles W. Urban, Westfield, N. J. App. filed April 13, 1914. For internal-combustion engines employed on automobiles, motorboats, etc.

1,285,172. SWITCH; James T. Hickey, Raritan, and John Schneider, Elizabeth, N. J. App. filed May 26, 1916. For control of high-tension electric currents and by means of which circuits carrying such currents may be broken in the open air and the ensuing spark harmlessly dissipated.

1,285,196. SANITARY CLOSURE FOR TELEPHONE MOUTHPIECES; Orion D. W. Inman, Beloit, Wis. App. filed May 3, 1917. To disinfect and fumigate mouthpiece.

1,285,199. VACUUM-OPERATED MAKE-AND-BREAK SPARK PLUG; Herbert G. Irwin, Spur, Tex. App. filed Dec. 3, 1917. By the varying impulses imparted to the piston incident to the vacuum formed in the engine the sparking of the plug is regulated to the work required.

# *Record of Electrical Patents*

Notes on United States Patents

1,285,215. METHOD OF AND APPARATUS FOR CONTROLLING THE RESISTANCE OF AN X-RAY TUBE; Edwin W. Kelly, Philadelphia, Pa. App. filed Dec. 26, 1913. Raising body with tube to a temperature causing emission of corpuscles for increasing the conductivity of main path.

1,285,223. SWITCH; Edward J. Kilmer, Corpus Christi, Tex. App. filed Jan. 3, 1918. A multiple-point switch for use in a lamp-socket plug that contains a number of bulbs.

1,285,243. ELECTRIC POCKET LAMP; Emil Kuhn-Frei, Zurich, Switzerland. App. filed April 7, 1916. A spring-driven dynamo replaces a galvanic battery.

1,285,246. APPARATUS FOR ELECTRICALLY CONTROLLING AIR BRAKES; Eldridge I. La Count, Worcester, Mass. App. filed Oct. 11, 1916. One of the objects is to provide a manually operated valve for cutting out the automatic control system from the regular air-brake equipment.

1,285,264. REGISTERING DEVICE; George A. Long, Hartford, Conn. App. filed Feb. 24, 1916. Of special utility when used with a telephone for registering the calls transmitted from a subscriber's station.

1,285,278. SPECIAL-SERVICE SYSTEM FOR MACHINE-TELEPHONE SWITCHING EXCHANGE; Frank R. McBerty and Lipa Polinkowsky, London, England. App. filed March 19, 1917. The repetition of busy calls may be provided for in an efficient and expeditious manner.

1,285,283. ROENTGENOSCOPE; Theodore B. McClintock, Chicago, Ill. App. filed Jan. 25, 1915. For facilitating fluroscopic examination of the human body.

1,285,293. LAMP SOCKET; William S. MacLewee, Yardley, Pa. App. filed Feb. 12, 1916. Having means for locking the two parts of the metal shell together.

1,285,303. STORAGE BATTERY; John P. Mentzer, Chicago, Ill. App. filed Jan. 14, 1918. Of "dry" type and having separators composed of kieselguhr combined with calcium sulphate and fiber.

1,285,305. ELECTROLYTIC APPARATUS EMPLOYING FILMED ELECTRODES; Ralph D. Bershon and John S. Riddile, New York, N. Y. App. filed Dec. 14, 1910. To minimize film deterioration.

1,285,319. PROCESS AND APPARATUS FOR CHARGING STORAGE BATTERIES; Thomas Spencer, Philadelphia, Pa. App. filed Sept. 30, 1916. To charge batteries with minimum energy waste and attention.

1,285,349. ELECTRIC SWITCH; Henry T. Paiste, Philadelphia, Pa. App. filed Nov. 12, 1914. To reduce friction between moving parts.

1,285,359. IGNITION MAGNETO FOR FOUR-CYLINDER INTERNAL-COMBUSTION ENGINES; Raoul A. Persin, Villiers le Bel, France. App. filed July 25, 1917. Two sparking plugs into which current is passed simultaneously by the distributer are fed by two distinct secondary circuits, and the spark produced at each of these plugs has its maximum intensity.

1,285,361. EMERGENCY ELECTRIC LAMP SOCKET; James E. Pettibone, St. Louis, Mo. App. filed June 15, 1917. To be easily and quickly applied to strands of current-carrying wires without removing the insulation and without involving use of insulating tape.

1,285,363. CARBON AND METHOD OF RECOVERING SAME FROM THE WASTE PRODUCT OF OIL-CRACKING; Robert D. Pike, San Francisco, Cal. App. filed July 25, 1916. Impurities eliminated by washing and roasting, leaving carbon in powdered form.

1,285,369. ELECTROPLATING APPARATUS; Louis Potthoff, Flushing, N. Y. App. filed Jan. 31, 1916. To confine plating currents to useful paths, avoiding current leakage and the undesirable plating of parts of the apparatus itself.

1,285,371. TRACTION SIGNAL FOR AUTOMOBILES; Russell C. Powell and Olive R. Faith, New Kensington, Pa. App. filed Dec. 1, 1915. Electrically operated direction indicator.

1,285,398. ELECTRICAL CONDUCTOR AND MOUNTING SAME IN ELECTRICAL APPARATUS; Reinhold Rudenberg, Berling-Westend, Germany. App. filed Sept. 18, 1913. For cooling the stator of high-voltage dynamos by using hollow conductors.

1,285,427. ADJUSTABLE LAMP SOCKET; Oscar M. Sheck, Cleveland, Ohio. App. filed July 7, 1917. Lamp may be given a partial turn in the socket to bring the filament to the desired position and the operative contact retained.

1,285,459. SIGNAL APPARATUS; John E. Sullivan, Covington, Ky. App. filed Dec. 14, 1916. Audible and visible direction indicator illuminates license number and also roadway in backward movement of automobile.

1,285,498. RELAY; Herbert A. Wallace, Pittsburgh, Pa. App. filed June 23, 1914. For use with railway signaling apparatus.

1,285,553. ILLUMINATING OIL CAN; William G. Bateman, Scranton, Pa. App. filed Aug. 19, 1918. Electric circuit is closed before opening valve permitting flow of oil.

(Issued Nov. 26, 1918)

1,285,576. TELEPHONE SWITCHBOARD; Chester C. Aller and Ole Bekkedahl, Portal, N. D. App. filed Nov. 8, 1917. To provide a simple and effective circuit arrangement of the common-battery switchboard type adapted for use in small city and town systems to replace the usual magneto system.

1,285,596. ELECTRIC BURGLAR ALARM; Bernhardt Beck, Cut Bank, Mont. App. filed March 9, 1918. Will cause a signal to be given whenever a key is inserted in the door lock.

1,285,619. ELECTRICAL HEATER FOR CARBURETORS; Wilbur A. Carter, Detroit, Mich. App. filed July 26, 1918. For heating by the generation of eddy currents electrically induced in an iron core surrounding the carburetor.

1,285,625. PROTECTIVE DEVICE FOR MOTOR CONTROLLERS AND STARTERS; Allan J. Cline, Chicago, Ill. App. filed Jan. 8, 1917. To prevent damage from accidental grounding of control circuit in remote-contact systems.

1,285,653. IGNITION DEVICE; Albert Erickson, Chicago, Ill. App. filed Jan. 2, 1918. The rotor shaft and the actuating trip lever are both moved by a torsional spring.

1,285,658. STORAGE BATTERY; Bruce Ford, Philadelphia, Pa. App. filed May 19, 1915. Means to indicate when the jar or container has been sufficiently filled.

1,285,659. STORAGE BATTERY VENTILATION FOR SUBMARINES; Bruce Ford, Philadelphia, Pa. App. filed March 20, 1916. Interior of submarine is automatically kept free from battery vapors or gases.

1,285,660. SECONDARY OR STORAGE BATTERY; Bruce Ford, Philadelphia, Pa. App. filed April 4, 1918. To minimize leakage between cells of a multiple voltage battery and at the same time to provide sufficient mechanical strength.

1,285,675. ELECTRIC SWITCH; Robert A. Gally, Cincinnati, Ohio. App. filed Sept. 7, 1917. A three-position switch control of one electric line.

1,285,690. PROCESS FOR THE TREATMENT OF ORES AND SOLID SALTS BY ELECTROCHEMICAL REDUCTION; Adrien A. M. Hanriot, Paris, France. App. filed May 18, 1914. Treatment may be applied directly to the ore.

1,285,698. SYSTEM OF CONTROL; Rudolf E. Hellmund, Swissvale, Pa. App. filed Sept. 13, 1916. For induction motors which may be employed from time to time as recuperative generators.

1,285,707. TROLLEY SUPPORT; Henry Holland, Cleveland, Ohio. App. filed Oct. 6, 1913. Employing an oscillatory frame to which the trolley pole is connected so as to be pivotal on alternative axes.

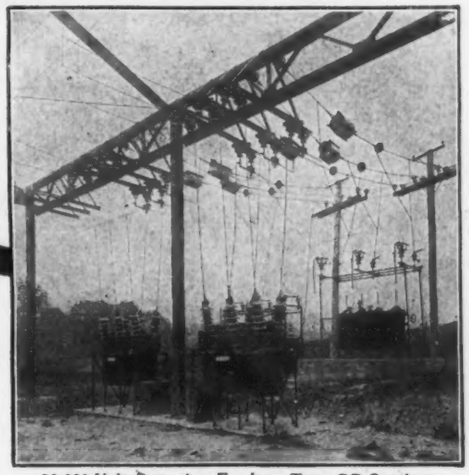
1,285,739. SWITCHING SOCKET; George C. Knauff, Chicago, Ill. App. filed Jan. 15, 1917. For connecting and disconnecting the circuit in a double-pole socket or connector.

1,285,786. CONTACT ARM FOR VOLTAGE REGULATORS; John D. Nies, St. Charles, Ill. App. filed Sept. 10, 1917. To prevent arm from bridging two adjacent contacts in alternating current rheostats.

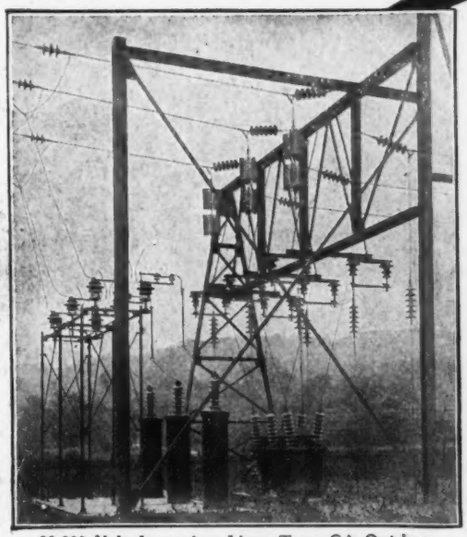
# Reliable

## High-Voltage, Outdoor Oil Circuit Breakers

**Through rain or shine, summer and winter, Westinghouse Outdoor Oil Circuit Breakers, insure continuous service. Years of successful performance, under the most adverse climatic conditions have demonstrated the entire adequacy of the Type G Line of Oil Circuit Breakers.**



22,000 Volt Outgoing Feeders, Type GB Outdoor Electrically Operated Automatic Overload Oil Breakers, pipe-frame mounted.



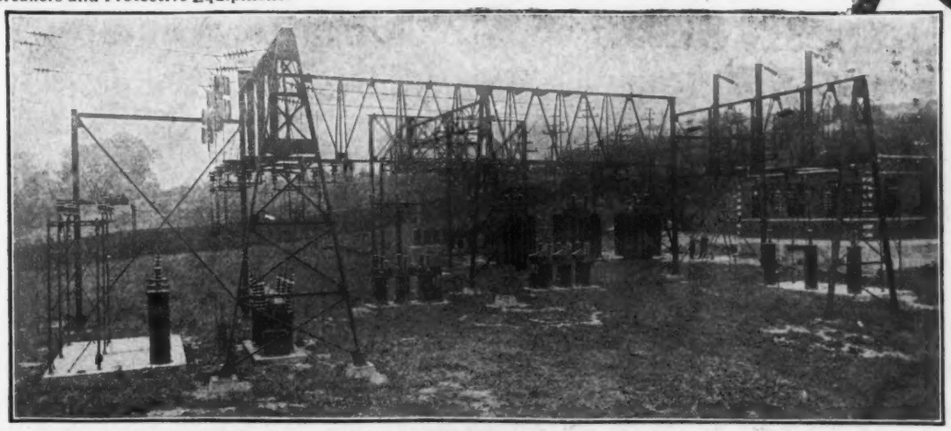
66,000 Volt Incoming Line, Type GA Outdoor Electrically Operated Automatic Overload Oil Breakers and Protective Equipment.

Outdoor substations represent the solution of present day problems by eliminating the extraordinarily high cost of substation building construction, with attendant war-time labor and material difficulties.

Westinghouse Outdoor Circuit Breakers make the outdoor substation a success.

We illustrate the modern North Substation of the Duquesne Light Company, Pittsburgh, Pa., stepping down from 66,000 volts and distributing at 22,000 volts.

**Westinghouse Electric & Manufacturing Co.**
East Pittsburgh, Pa.
*Sales Offices in All Large American Cities*



General View showing 66,000 and 22,000 Volt Oil Circuit Breakers; Protective Equipment and 12,500 Kva. Step-Down Transformers.

# Westinghouse

TRADE MARK

Oiled Paper Oiled Silk
Varnished Cambric

*Black and Yellow Varnished Tubing*

Electrical Machine, Cable and Magneto manufacturers use IRVINGTON INSULATION when building new equipment. Electric Transportation Systems use IRVINGTON INSULATION.

Specify IRVINGTON INSULATION when making all repairs.

IRVINGTON VARNISH & INSULATOR CO.
Irvington, New Jersey.

# JUST PART OF A DAY'S OUTPUT

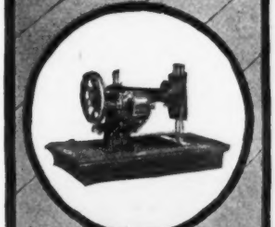
MOUNTING AND PACKING

Every day sees new evidences of the increasing popularity and demand for

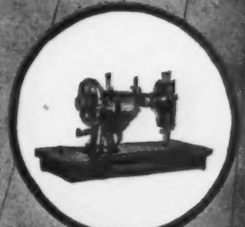
## *Western Electric*
## PORTABLE SEWING MACHINES

If you are not getting your share of this highly profitable business on a line that practically sells itself—it's not too late even now to make a running start.

You can do it, too, by making full use of an exceptionally attractive assortment of sales helps that we will send to you upon request—without charge.

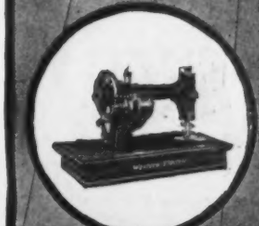


No. 1
VIBRATOR TYPE



No. 2
ROTARY TYPE

No. 3
ROTARY TYPE



No. 4
TWO-SPOOL TYPE

***Western Electric Company***
INCORPORATED
OFFICES IN ALL PRINCIPAL CITIES

J-P-Co. REG. IN U.S. NOARK PAT. OFF. FUSE

NOARK

JOHNS-MANVILLE

ELECTRICAL DEVICES

# The Even Ferrule Insures a Perfect Contact

LAY a straightedge alongside any ferrule contact "Noark" Renewable Fuse and hold them to the light. The evenness of both parts of the ferrule is immediately apparent

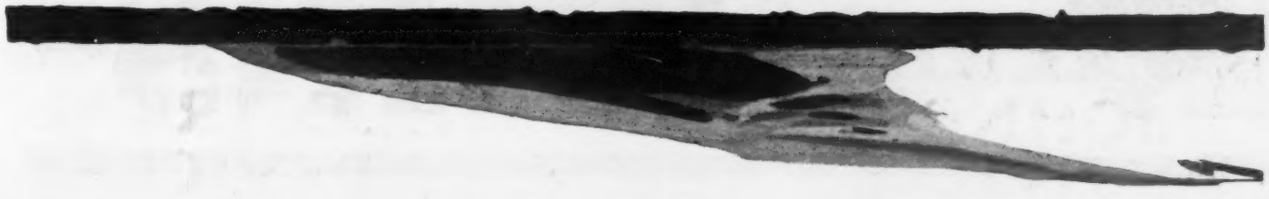
In the "Noark" Renewable Fuse not only is perfect ferrule contact with the clip assured, but also proper connection between the ferrule and the link, for the end of the cap makes a wiping contact with the link.

These are only two of the advantages in "Noark" Renewable Fuses. There are so many out-of-the-ordinary features about this new line that we suggest you ask your jobber or the nearest Johns-Manville house electrical department to show you samples.

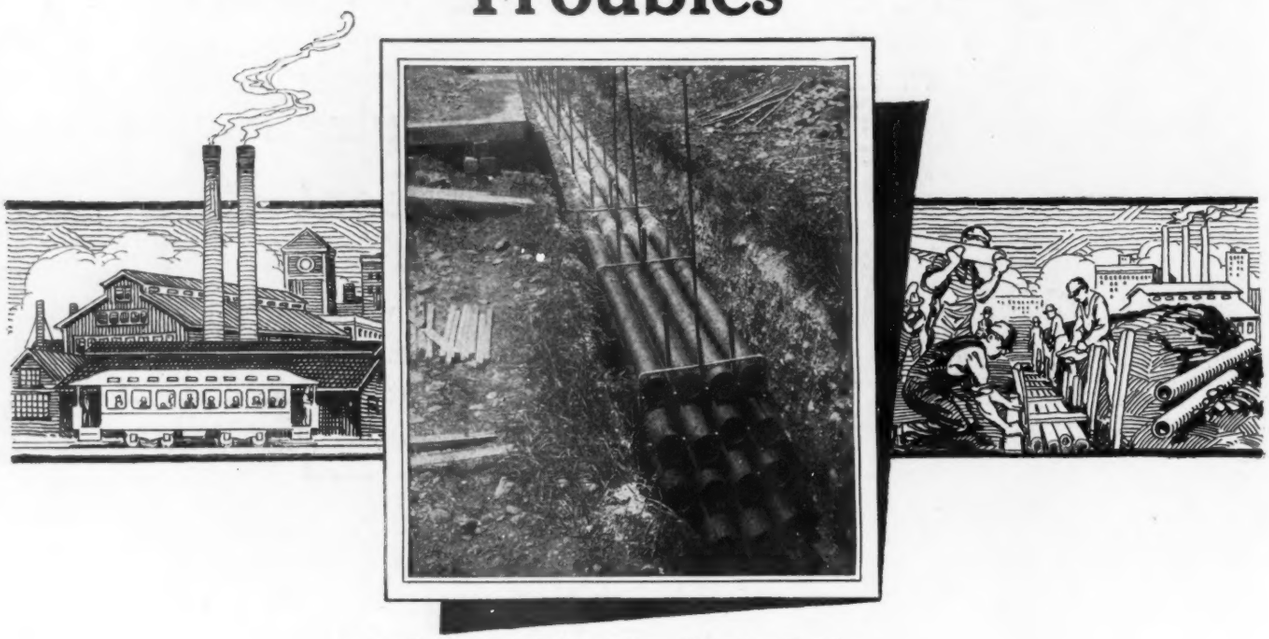
**H. W. JOHNS-MANVILLE CO.**
New York City
*10 Factories—Branches in 63 Large Cities*

# RENEWABLE FUSES

Manufactured by the Johns-Pratt Co., Hartford, Conn.
H. W. Johns-Manville Co., Sole Selling Agents.



# To Eliminate 90% of All Cable Troubles



*ohns-Manville Fibre Conduit Aligned in Trench*

THE origin of ninety per cent. of all cable troubles is the hardened cement drippings which protrude into the duct and cut or score the cable sheath when it is "pulled." There can be no drippings in Johns-Manville Fibre Conduit as the smooth machine joints require no cement to make them tight. And Johns-Manville Fibre Conduit is easy to lay as it is self-aligning, and requires a minimum depth trench.

A completed Johns-Manville Fibre Conduit duct is a smooth, watertight tube, possessing great mechanical and dielectric strength. It is unaffected by the severest sub-soil conditions or stray currents. It will not break or crack in handling, is practically indestructible from any natural cause, and its extremely light weight reduces freight and handling charges 80%.

Compare these qualities with those of clay, tile or wood conduits, and you have the reason why you should specify this low-cost-per-trench-foot fibre conduit for your next job.

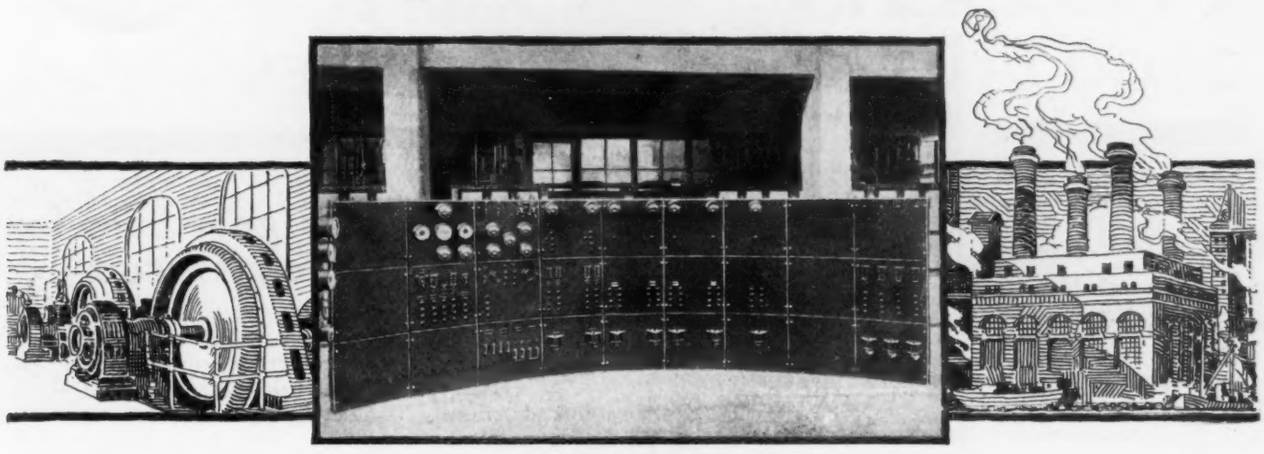
Write for our 70-page Construction Data Pamphlet. It gives full construction details with handy tables and curves.

H. W. JOHNS-MANVILLE CO.
New York City
10 *Factories—Branches in 63 Large Cities*

JOHNS-MANVILLE SERVICE
COVERS THE CONTINENT

JOHNS-

# Johns-Manville Ebony Asbestos Wood



*Ebony Asbestos Wood—Pacific Gas and Electric Co., San Francisco, Cal.*

HERE are five definite reasons why Johns-Manville Ebony Wood is better than stone, slate or marble.

1—It is manufactured and cut to meet your needs—eliminating wastage.

2—Its comparative light weight makes it easier to handle and reduces freight charges.

3—It is highly fire resistant, yet it can be sawed or cut to shape like wood.

4—It is practically unbreakable—due to its fibrous structure, and will not warp, shrink, crack or buckle, even under the most severe service conditions.

5—It has no metallic veins or other electrical conductor in its composition but is built of Johns-Manville Asbestos Fibre and binding cements impregnated under heat and pressure—making it a highly dielectric material.

For switchboards, panel boards, switch bases and other central or sub-station use.

Ask the Electrical Department of the nearest Johns-Manville Branch Office for an interesting booklet: "Asbestos Wood in Ebony and Transite Form."

**H. W. JOHNS-MANVILLE CO.**
**New York City**
10 *Factories—Branches in 63 Large Cities*

# MANVILLE

# NOARK
## 2500 VOLT FUSES

J·P·Co. REG. IN U.S. NOARK PAT. OFF. FUSE

## —the necessary guardians for every Primary Circuit

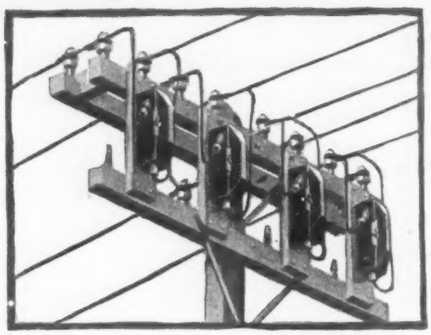
TODAY—if you take a chance with inadequate primary protection—you are not only likely to lose valuable equipment—but to seriously hamper the national reconstruction programme.

Accidents to your high tension apparatus will bring you squarely up against:

Loss of production.
Loss of labor and time.
Loss of investment and equipment.
Difficulty—perhaps impossibility—of immediate replacement.

Every one of these items will cost you a good bit of money—compared to which the cost of Noark Primary Fuse Protection is negligible.

Precise calibration, and correct designing throughout have made Noark 2500-volt Fuses superior for your high potential circuit—and a low-priced insurance against short circuits and overloads.



### Noark Primary Boxes

—are built with the same particular care and thoroughness that have made Noark products everywhere take precedence for dependability.

Every Noark Primary Box is tested under conditions four times as severe as it will meet in actual service—before it is allowed to become a part of your high potential circuit. This automatically rules out the possibility of 'flaws" or imperfections—and insures absolute safety to your transformers.

Make Noark Safety a part of your equipment. The nearest Johns-Manville branch house electrical department will gladly give you details.

## Present Equipment Must Be Protected

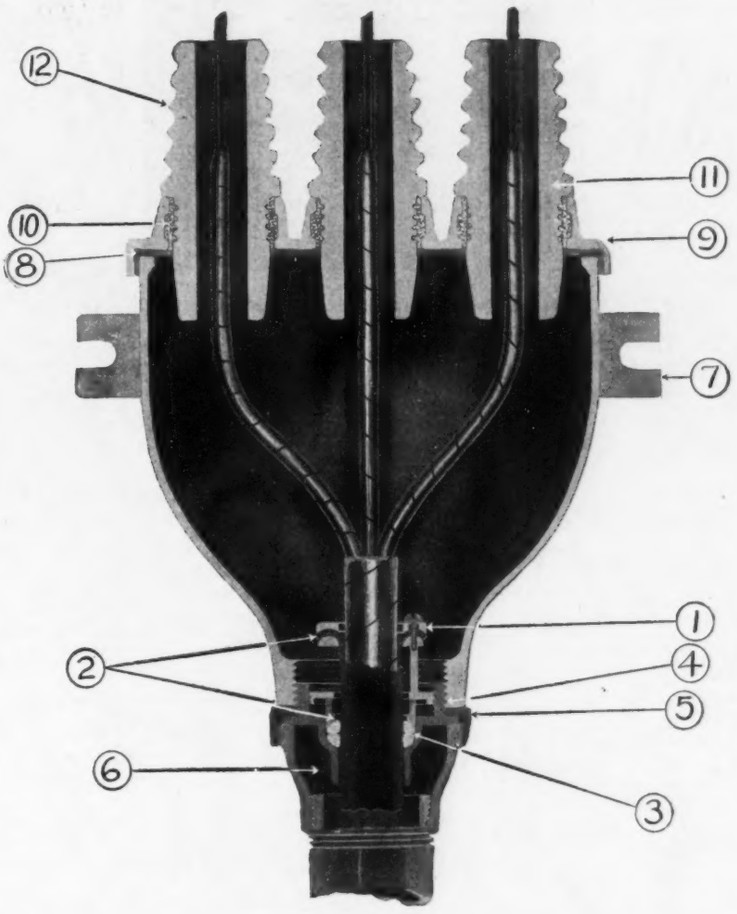
The same national necessity which has made your present apparatus worth many times its original value—also calls for the proper primary box protection for your transformers.

**H. W. JOHNS-MANVILLE CO.**
New York City
*10 Factories—Branches in 63 Large Cities*

**Manufactured by the Johns-Pratt Co., Hartford, Conn.**
**H. W. Johns-Manville Co., Sole Selling Agents.**

JOHNS-MANVILLE SERVICE COVERS THE CONTINENT

# JOHNS-MANVILLE
# ELECTRICAL DEVICES




# Why You Get MORE For Your Money In G. & W. Potheads

1. Brass ring mechanically supporting and bonding cable without crushing strain on cable sheath.
2. End of lead sheath mechanically belled out at least one and one-half inches in compound. This elevation of complete cable into the compound provides absolute protection against moisture.
3. Soft packing to prevent leakage of compound, compressed by screwed gland.
4. Sizes of openings standardized and all types of cable entrances (clamped ring, wiping sleeve or plain plug) universal.
5. Universal nut when conduit coupling is desired. All sizes of conduit couplings interchangeable.
6. No leakage of compound into conduit or coupling. No packing of coupling required.
7. Bracket slotted for convenience in installing.
8. Rubber gasket seated upon ground surface with bolted cover makes joint compound tight allowing outlet tubes to be filled with compound.
9. Substantial metal lids. To obviate heating on large sizes non-magnetic metal is used.
10. Outlet bushings cemented in eliminate moisture or dirt inside pothead.
11. Proper thickness and quality of porcelain.
12. Large leakage surface for rated voltage.

**Standardized construction with universal fittings enables quick shipments of any shape or size of pothead for upright, horizontal or inverted use. Any pothead can be supplied with bolted cable entrance if turning of bell must be avoided. The most complete standardized line. Built for dependability.**

## G & W Electric Specialty Co.

***Distribution Engineers. Manufacturers of Potheads, detachable and non-detachable, Switching and Distribution Boxes, Overhead and Underground Distribution Specialties.***

**7440 South Chicago Ave., Chicago, Ill.**

# Square D Switches

## ELECTRIC SHOCK KILLS EVANSKY

### Driver Electrocuted at Hackensack as He Throws Switch

Abraham Evansky, of 406 Mon... roe street, a driver for the ... Company was almost instantly killed early this morning when he attempted to turn on an electric switch in a small ice cream store on First street, Hackensack. Evansky entered the store for the purpose of delivering some cream. The interior of the store was rather dark and knowing the whereabouts of the switchboard, he tried to turn on the lights.

His hands were wet, and in some manner he must have had one hand on the switch while the other came in contact with the current. ... was unable to release the switch. Evansky ... from the switch. ... electric shock ... for help. ... body, the manager ... the store ... Another ... him but his efforts proved useless. Before the electricity could be turned off, Evansky had breathed his last. He is survived by ... and four children. Evansky was in the employ of the Pas... Ice Cream Company for the ...

William P. Flinn, 50 years old, 16 Merrill Street, former deputy sheriff, was found dead at 8:30 a. m. today at the ... Co., where he was employed as a watchman. His body was found near a half-opened power switch with burns showing on the right hand. Coroner Morgan Parker is investigating.

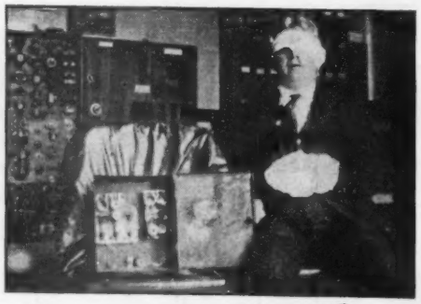
Mr. Frederick C. Mathews,
Detroit, Mich.

Dear Sir:

An open knife switch in a large depa... store caused a very serious accident to a young lady employed in the store. The switch was located on a panel board, possibly six feet from the floor, presumably safe. One morning, on her arrival at the store, she attempted to throw the switch to turn on the light in her departme... as was her custom, when a heavy bracelet which she wore on her wrist came in direct contact across the two-pole switch, causing an arc which burned the flesh into the bone. She was laid up for seven weeks and has never fully recovered the use of her arm. The scars are also very d... ing.

A settlement was made by the owne... store—something that could have been ... by the installation of a protective devi...

Very truly y...
R. E. D...



This gentleman has not "been over the top." He just opened his service box and pulled his service switch. The outside service wires were crossed up with a 5000 volt D. C. Arc Circuit.

He now has a safety switch operated from the outside and was so pleased with it that he consented to have his photo taken with the old box.

Of course, it is the same old story. Look the garage over after the Fourth is gone. But people continued this way never forget.

GEORGE ... TON,
Chief Electrical Ins...
Grand Rapids, Michigan

## ELECTRICIAN MEETS DEATH

CARL M'DANIEL SHOCKED TO DEATH AT BURT POWDER WORKS

RECEIVES LIGHT SHOCK AT A SWITCH WHICH KILLS HIM

While throwing on a switch in the factory of the Burt Powder Works, near Coverts station, Carl McDaniel slipped grasping the uninsulated rod of the switch and was instantly killed by the electric shock this morning at 4:30 o'clock.

A current of 440 volts, which under ordinary circumstances would not cause death, passed through the victim's body. It is thought that Mr. McDaniels had a weak heart.

The body was brought to the Rice morgue and an effort was made to locate his home. Papers were found on the man's body addressed from Mason City, Iowa, where he is said to have been before he came to New Castle. He was an electrician and had been in the employ of the company but a short time. As yet the relatives have not been located.

## DIES FROM SHOCK

### VOORHEES C. MINOR KILLED AS HE TURNS ON SWITCH

Body Taken to Hospital But Death Occured Almost Instantly From 440 Volts

Voorhees C. Minor, residing at 40... South Jefferson avenue, was instantly killed at 5:30 o'clock Sunday afternoon when he received 440 volts of electricity while turning a switch at the ... company's ... plant on ... street, where he was employed. Coroner Charles ... was summoned and has called an inquest for Tuesday afternoon.

Minor was ... shaking ice cream ... was about to turn on the current ... when the accident happened. The ... has been broken off ... switch. Everything contributed ... the accident of yesterday. Mr. ... or wore shoes with steel plates ... the bottom and ... standing in a ... of water on a wet concrete ... The switch ... and received 440 volts, caus... him to topple ... to the floor. A ... was burned entirely through ... right little finger ... death ... used to have resulted ... he shock ... It ... thought ... still ... Nicholas ... hospital ... physicians, ... er, found that ... was ... stantaneous. ... Coroner ... was probably in... gation and ... Charles Young investi... should be held. ... that an inquest ... Before: ... The members of the ... by Coroner Young ... P. J. Myers, R. C. Warner, Hugh ... Gordon, Raymond Ogden, R. E. Brig... lock and J. Banks. ... Mr. Minor, who was 23 years old, ... is married and has two children, ... lard, aged ... years. ... D. Min... eral arr... comple...

LAMPS WIRING SUPPLIES

The Electric Shop

ERNEST B. KORST, PROP.

PHONE 424-W1 8 CATHEDRAL PLACE

ST. AUGUSTINE, FLA. 4-13-18

Mr. Frederick C. Mathews,
63 Mullett St., Detroit, Mich.

Dear Sir:

In the ... church here the 2 H. P. single phase motor operating the pipe organ is controlled from a double pole knife switch located on the front of the organ near the keyboard. The lady organist accidentally brushed against it with a silver mesh bag which resulted in the destruction of the bag, the ruining of her dress and a severe shock to her nerves. The switch has since been enclosed.

Yours truly,
THE ELECTRIC SHOP,
C. B. Korst

THE ORIGINAL SAFETY SWITCH

Square D. Switches prevent accidents like these.

Knife
Danger!
ELECTRIC SHOCK IS CAUSE OF SOLDIER'S DEATH AT THE CAMP
Private [illegible] A. Werther [illegible] Electrocuted While on Duty.
Letter From Grover C. Schumaker
Cleveland, Ohio, September 21, 1918
Frederick C. Mathews, Publisher,
Detroit, Mich.
Dear Sir:—Following are a few of my experiences with open knife switches which may be worthy of publishing.
One noon while throwing in switch on a 20 H. P. motor the blades did not slide into the contacts properly. The contact thus made was inadequate to carry starting current of the motor, the result being that switch began to burn and threw a great flash which left me blind about 24 hours, burned my right hand, arm and side of my face. This confined me in the hospital four days and kept me from work two weeks.
On another occasion I threw a switch in on a H. P. motor and got one hand on the blades of switch and the other on a steel cabinet. Luckily the switch was high and when I became conscious enough that I broke contact.
Aside from this I have received several shocks from open knife switches and am a firm believer in their abolishment.
ELECTRIC SHOCK IS FATAL TO GROOVER
Everett Groover, Age 22, Fatally Hurt At Ray Livery Barn Yesterday Afternoon.
Everett Groover, age 22, was instantly killed by an electric shock at 5 o'clock last evening while working on elevator at the Ray livery barn, 815 Jackson street. Coroner Earl Sells is conducting an investigation into the death.
Groover [illegible] Alexandria, [illegible] the accident throwing [illegible] operated an electric switch in the barn when his hand touched the metal portion of the switch instead of the wood handle. The shock rendered him unconscious and Darus Leighton, a boy, nearby ran to his aid. Leighton pulled Groover's hand loose from the switch. The young man was dead before further aid arrived. He was taken to Clayte Sells morgue in an ambulance.
Mr. Groover had been working here only about a month. He is survived by a widow, who is in a serious condition from the shock of the accident, two children, Thelma and Jack; two brothers, and two sisters. The family resides at 123 West Eighth street.
FUNERALS.
The funeral of Joseph Chapman was held at 2:30 o'clock this afternoon at the Christian Holiness church, with burial in Maplewood cemetery.
The funeral of the three year old daughter of Mr. and Mrs. Clarence Chambers, residing northwest of the city was held today from the house.
BLAST SHAKES SHELL PLANT; 2 DIE, 12 HURT
Philadelphia, Oct. 28.—A man and a woman were killed and about a dozen other persons were injured, some seriously, in an explosion today in the assembling room of the Eddystone Ammunition company's plant at Eddystone, Pa. The accident was caused by an electric fuse blowing out and igniting high explosives.
NEWSIES' PRANK KILLS PRESSMAN
2 Coldwater Workmen Crushed When Wheels Start.
Coldwater, Mich., June 19.—While working under a large cylinder press in the Daily Reporter office, Frank Parker, aged 35, and Grant Smith, 60, were fatally crushed by the starting of the press accidentally Wednesday. Parker is not expected to live. A moment before he died Parker said, "Tell my girl good-bye." His father is a Civil War veteran, standing near the press to get the first paper, saw his son crushed. Newsies accidentally started press.
Could Cite Many Disasters Due to Open Knife Switch
A Letter from F. W. FERGUSON, Lorain, Ohio
Mr. F. C. Mathews,
Detroit, Michigan.
Dear Sir:
The superintendent handed me today a copy of your Electrical Safety Magazine. After reading it over, I recall a very sad accident that happened to a young fellow at the Clifton Copper Company, Clifton, Arizona, while I was employed as chief electrician at their smelter.
The equipment was 550 V. D. C. The practice there was all open type work, and any old way would do. Here is what happened. The lighting system was 5-110 V-16 candle carbon lamps in series, single fuse and S. P. knife switch. The young man in question worked at night and would light his cigarette by opening the switch until an arc was drawn, when he would stick his face up and light the cigarette.
Owing to changes about the furnaces, more light was needed, and it was desired to control them from a particular switch. Some 30 additional series of lights were added to the 5 already on the switch. When the young man came on duty that night he proceeded to light his cigarette, but instead of the tiny arc, as before, a terrific flash came when he slowly opened the switch, severely burning his hand and face and losing the sight of one eye.
Moral. Had they used up-to-date equipment in the way of safety devices, this accident would not have happened, and the company would have spared an expensive law suit.
I could cite you many disasters—accidents due to open knife type switches.
If this proves the kind of news you can make use of, I will be pleased to hear from you.
Yours truly,
F. W. FERGUSON,
31
"The Switch"
By HOWARD FURNISS, with Bethel Maine R. R., Bethel, Del.
Two years ago as superintendent of the machinery of a local shipbuilding plant I happened to be near a bunch of men lacing a large rip saw belt. This was almost finished and all the men had gotten down from the shaft above with the exception of one who remained there a minute to tighten a set screw in the operating pulley. He had almost finished this when slightly changing his position on the shaft his foot accidentally knocked the switch on, which started the shaft turning which threw him against the pulley catching his arm between the pulley and the belt. He was thrown over once this way and when the pulley had made one revolution his arm was loosened and he dropped down on the saw which by this time had gained very great speed. One of his arms was sawed off and he was sawed half way through his back when pulled away from the saw. He died on the way to a hospital.
Later officials of the company looked into the matter and found that 55% of all the accidents that have occurred in this plant and all its branches were caused by open knife switches. Soon after this Square D Steel Enclosed Switches were installed and since then this company has not paid one-tenth as much for accident claims and insurance and have not had one single electrical accident.
7

**Names and dates of papers in which these items appeared will be gladly furnished on request.**

**SQUARE D COMPANY, Detroit, Michigan**

*Canadian Factory, Walkerville, Ont.*

# Concluding A YEAR OF ACHIEVEMENT

AMERICA'S splendid industrial achievements in the memorable year of 1918 were made possible through the sound judgment displayed in so systematizing production as to conserve needed materials and to effect economies in operating and maintenance.

# ECONOMY renewable FUSES

have played a noteworthy part by protecting vitally important electrical circuits of the U. S. Navy, the leading steel and powder mills and thousands of representative plants in all branches of industry against the fire and accident hazards of overloads and short circuits. It was due, in part, to their accurate rating and all-around efficiency that the wheels were kept turning with safety.

They have directly saved millions of dollars for their thousands of users because they cut annual fuse maintenance costs 80 per cent. as compared with the use of "One-Time" fuses.

We now face the great reconstruction period. Conservation and economy must be practiced more extensively and constructively than ever before. Economy Fuses are essentials as factors of practical economy and conservation.

Use them on all circuits—in industry and in the Home.

*Write for Catalog* 19

**Economy Fuse & Mfg. Co.**
**Kinzie and Orleans Streets**
**Chicago, U. S. A.**

*Sole manufacturers of "ARKLESS" —the Non-Renewable Fuse with 100% Indicator.*

***Economy Fuses are also made in Canada at Montreal***

# NATIONAL Renewable FUSE

The renewable fuse with the powder packed REFILL and

*Rating always in plain view*

The *only* fuse with the renewable feature

**APPROVED** by the Associated Factory Mutual Fire Insurance Companies

Federal Sign System (Electric)
Lake and Desplaines Sts., Chicago
627 W. 43rd St., New York
Branches in all Large Cities

COUPON

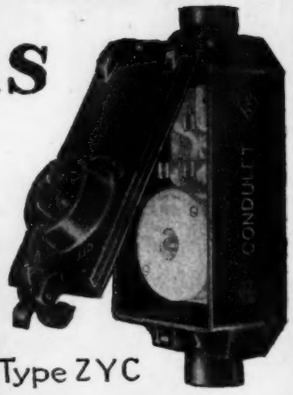
Please send me full information and prices of National Renewable Fuses.

Name _____

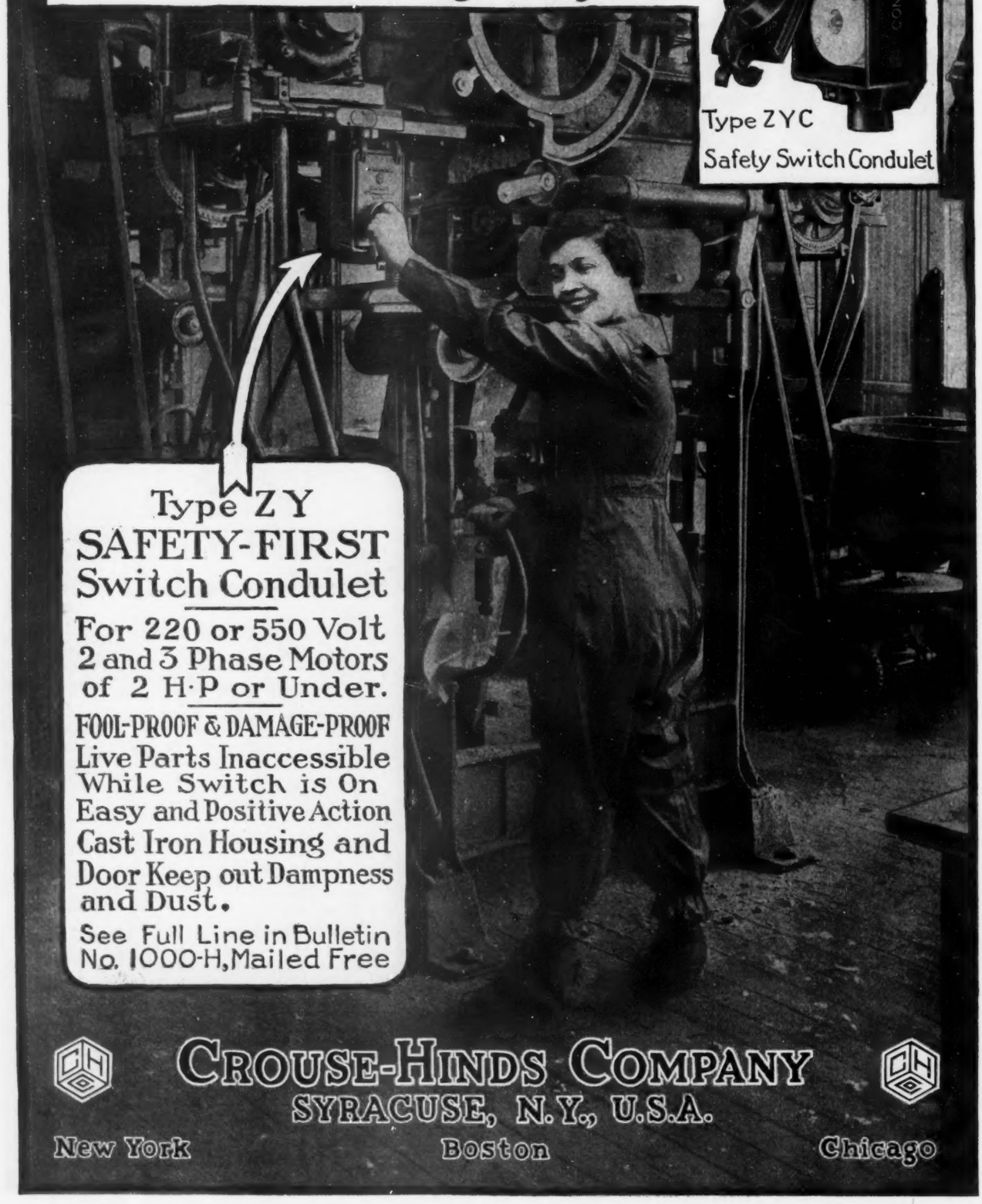
Company _____

Address _____

# Protect Our Girls From Injury!




Type ZYC
Safety Switch Condulet



Type ZY
SAFETY-FIRST
Switch Condulet

For 220 or 550 Volt
2 and 3 Phase Motors
of 2 H·P or Under.

FOOL-PROOF & DAMAGE-PROOF
Live Parts Inaccessible
While Switch is On
Easy and Positive Action
Cast Iron Housing and
Door Keep out Dampness
and Dust.

See Full Line in Bulletin
No. 1000-H, Mailed Free

CROUSE-HINDS COMPANY
SYRACUSE, N.Y., U.S.A.

New York Boston Chicago

# Sell These Rugged Irons

Practically every plant requires electric soldering irons to speed up some part of its work.

Call on them with samples of a few sizes—you will find that they know about C-H Irons and new Safety Racks (shown below) because through circularization and advertisements in Factory Magazine, Iron Age, and others we are explaining the uses and advantages of

C-H

# SOLDERING IRONS

## and Automatic Safety Racks

needed by Biscuit Manufacturers, Telephone Companies, Railroads, Electricians, and scores of miscellaneous manufacturers.

**THE CUTLER HAMMER MFG. CO.**
**Milwaukee and New York**

**New York, Chicago, Boston, Pittsburgh, Philadelphia, Cleveland, Cincinnati, Washington, Birmingham, San Francisco, Kansas City, Mo.**

# THE ELECTRIC CABLE COMPANY

ELECTRICITY has become recognized as one of the great elements of modern life. As a factor for industrial and household economy and convenience it ranks first among the world's most practical and adaptable forces.

*Electricity for the Factory*

Electrical current is the master workman of any shop. As motive power for enormous cranes or for the most delicate machine, it is always adequate—unlike other forms of power—its cost is applied only when in actual use.

*Electricity for the Home*

Electricity is the universal servant in the house. By means of the many devices now obtainable, housewives are, more than ever before, independent of servants. Electricity is clean, obviously economical and always a willing, handy helper in the home.

*Consult an Expert*

Electricity is safe and simple to use—it is only necessary to have an expert to plan and install the equipment. The electrical contractor, the electrical dealer, the architect, the central power company, and the manufacturers of electrical devices are all experts and will gladly assist you in getting the best service.

*Dependable Wire*

All electrical current is finally delivered by insulated wire. The usefulness of electricity therefore, is dependent upon the quality of wire used and its correct installation.

Ecco Wire is always dependable and is so recognized by experts. It is a standard of quality and by its use can be judged the quality of materials and workmanship of an entire installation. Call in an expert at once. Connect up to the great reservoir of electricity with Ecco Wire and begin to enjoy its benefits and economies.

**ECCO Dependable Insulated WIRE**

THE ELECTRIC CABLE CO.
10 EAST 43rd STREET, NEW YORK CITY

*Makers of Ecco Wire for every purpose where rubber-covered wire is used*

IF YOU were a factory owner or a home owner and came across this advertisement in the Saturday Evening Post, Literary Digest or any other of the mediums in which it appears, you would be brought a step nearer to realization of what electricity could do for you.

And you would receive a definite suggestion of how to go about getting your electrical needs satisfied.

Every piece of Ecco publicity is designed to cultivate the market not only for electrical equipment and insulated wire, but also for the services of the technical specialists and organizations associated with the electrical industry.

It is through such cooperation that, we believe, the interests of the electrical industry are best served and the satisfactory use and installation of our products assured.

# THE ELECTRIC CABLE COMPANY

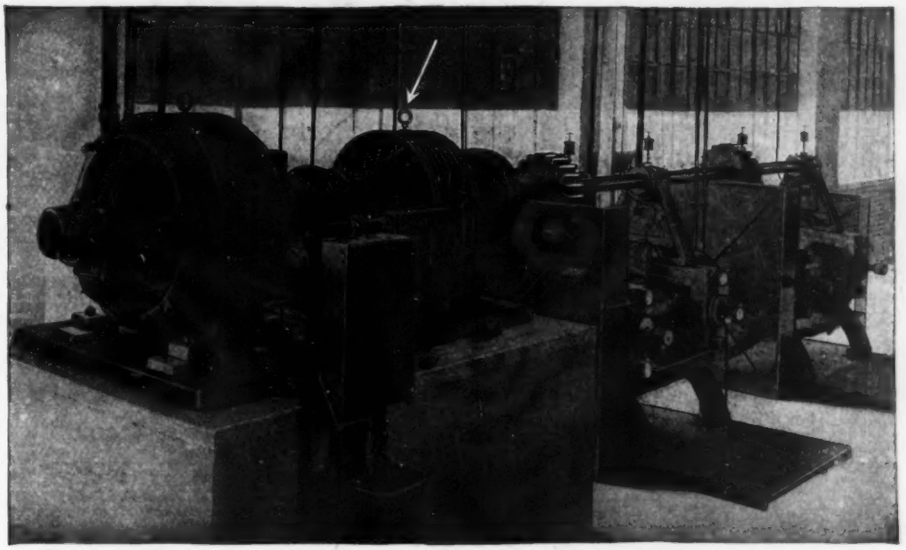
# SPEED UP PRODUCTION

TURBOGEAR
FAST PATENTS

## RUBBER MILL DRIVE

**Turbo Gear Steps Up or Steps Down Speed**

***The arrow shows the Turbo Gear***



**75-H.P. Turbo-Gear reducing the motor speed from 690 to the speed of the mill shaft at 90 R.P.M.**

A Turbo-Gear drive means a straight line drive from motor to driven machine—no offset shafts. This means no side strain on the motor shaft or bearings. Of course the motor lasts longer.

Other advantages of Turbo-Gears are:

1. **Small floor space.**
2. **High efficiency (98%).**
3. **Practically no maintenance charges.**
4. **Noiseless—no vibration.**
5. **Positive, reliable transmission of power.**
6. **No slip—no lost motion.**

*Why not install a Turbo-Gear in your plant?*

**Bulletin 100 is interesting. Send for a copy.**

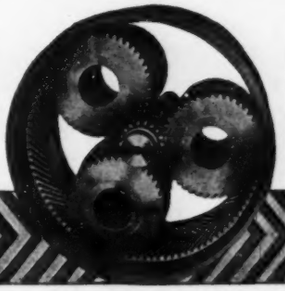
## The Poole Engineering & Machine Company

**Manufacturers of Gears and Power Transmission Machinery Since 1843**

**Baltimore** **Maryland, U. S. A.**

CHARLOTTE, N. C.....Realty Bldg.
CHICAGO.....Old Colony Bldg.
DALLAS.....1405 Southwestern Life Bldg.
DENVER.....First National Bank Bldg.
DETROIT.....423 Dime Bank Bldg.
EL PASO.....615 Mills Bldg.

Canadian Representatives:
Engineering Company of Canada.....Montreal



MILWAUKEE.....Wells Bldg.
NEW YORK.....50 Church St.
PHILADELPHIA.....929 Chestnut St.
PITTSBURGH.....781 Union Arcade Bldg.
ST. LOUIS.....2211 Olive St.
SALT LAKE CITY.....218 Judge Bldg.
SAN FRANCISCO.....503 Mission St.
SEATTLE.....2012 L. C. Smith Bldg.
SYRACUSE, N. Y.....504 City Bank Bldg.

RILEY UNDERFEED STOKERS

TRADE MARK Rx REGISTERED

MURPHY AUTOMATIC FURNACES

# Service—that goes Deeper—

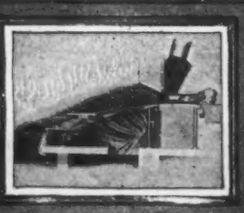
Last week we pointed out that the main reason for combining the sales efforts of the MURPHY IRON WORKS with that of the SANFORD RILEY STOKER COMPANY was—*service*.

While there will be no change in the policy of either organization, this combination, however, will enable us to render the greatest possible service to all customers.

Stoker business today is more dependent upon service than any one thing. Stoker service is more than a cost transaction which places a certain amount of equipment in your plant, leaving it at your mercy after the equipment is installed. Service as we practice it *goes much deeper;* it begins at the source; takes your needs into consideration long before you do, and stays with you as long as the equipment is in operation.

Bear in mind that this new and enlarged *Riley and Murphy Service* is not a cold abstract form of service grudgingly rendered—but is a *friendly service* which takes a personal interest in the owner's welfare and the successful operation of the plant.

After January 1, 1919, this service will be accessible through a greater number of central points. When you need advice regarding the operation of your present equipment or on the selection of new equipment—get in touch with our engineers in your territory. They will gladly analyze your plant condition and prescribe the remedy.



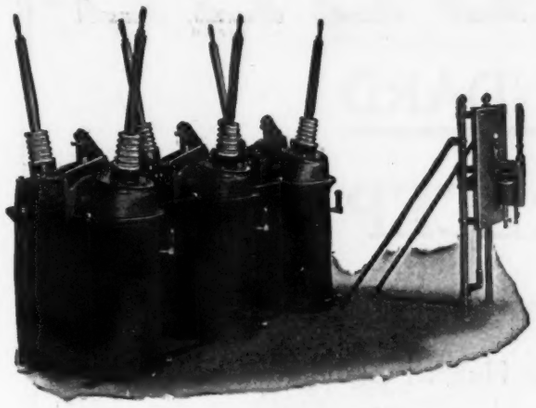
SANFORD RILEY STOKER CO.

Worcester, Boston, Philadelphia, New York, Pittsburgh, Buffalo, Detroit, Cleveland, Cincinnati, Chicago, St. Paul.

∴ MURPHY IRON WORKS ∴

CONDIT

**Oil Switches and Circuit Breakers**

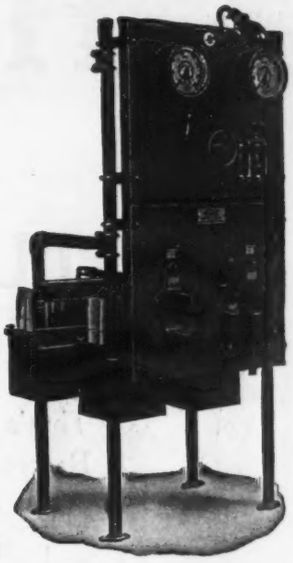


**TYPE D-15**

**Maximum Amperes, 300. Maximum Volts, 44,000**
**Bulletin No. 426**

CONDIT

**Motor Starting Panels**

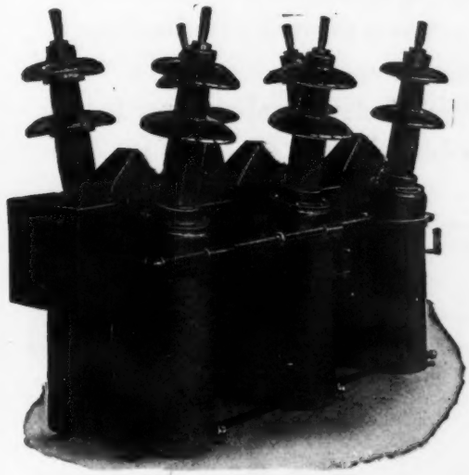


**TYPE M-1**

**Bulletin No. 416**

CONDIT

**Oil Switches and Circuit Breakers**

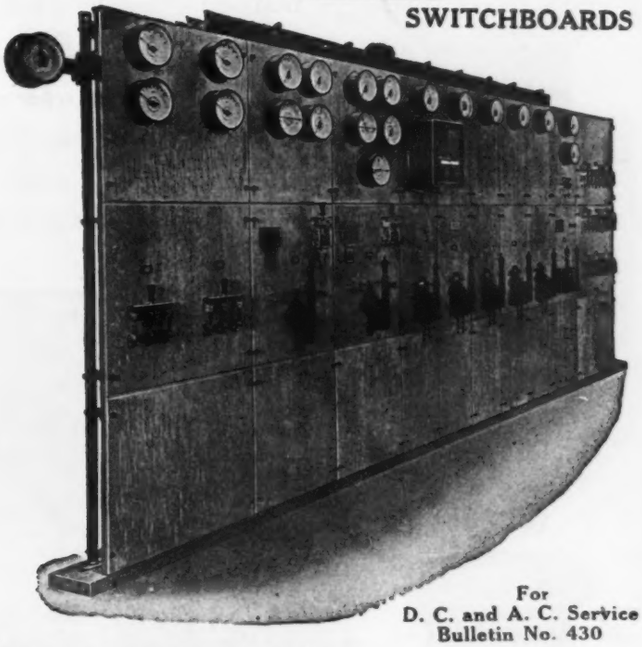


**TYPE D-16 OUTDOOR**

**Maximum Amperes, 300. Maximum Volts, 44,000**
**Bulletin No. 433**

CONDIT

**SWITCHBOARDS**



**For**
**D. C. and A. C. Service**
**Bulletin No. 430**

**WRITE FOR BULLETINS**

# Condit Electrical Mfg. Company, South Boston, Mass.

***Manufacturers of Electrical Protective Devices***

Akron, Ohio, 323 Ohio Bldg.
Albany, N. Y., 124 Hudson Ave.
Birmingham, Ala., Brown-Marx Bldg.
Buffalo, 604 Electric Bldg.
Charlotte, N. C., Commercial Bank Bldg.
Chicago, 19 So. Wells St.
Cincinnati, 1309-10 Union Trust Bldg.
Cleveland, 1202 Illuminating Bldg.
Dallas, 408 So. Ervay St.
Denver, Gas & Elec. Bldg.
Detroit, 617 Ford Bldg.
Kansas City, Mo., Interstate Bldg.
Los Angeles, San Fernando Bldg.
Miami, Fla., 329 Thirteenth St.
Minneapolis, 716 McKnight Bldg.
New Orleans, 821 Union St.
New York City, 39 Cortlandt St.
Philadelphia, 929 Chestnut St.
Pittsburgh, 706 May Bldg.
Salt Lake City, 218 Judge Bldg.
San Francisco, 583 Howard St.
Seattle, 552 First Ave. S.
St. Louis, La Salle Bldg.
Washington, D.C., Conduit Rd. and Elliott St., N. W.

*Northern Electric Company*
LIMITED

Montreal Winnipeg Halifax Regina Ottawa Calgary Toronto Vancouver London Ont.

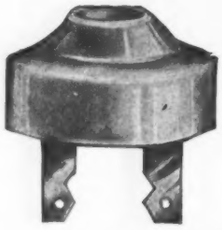
CONDIT: *the Synonym of Safety in Electrical Protective Equipment*

# HUBBELL

## STANDARD

## PLUGS and RECEPTACLES

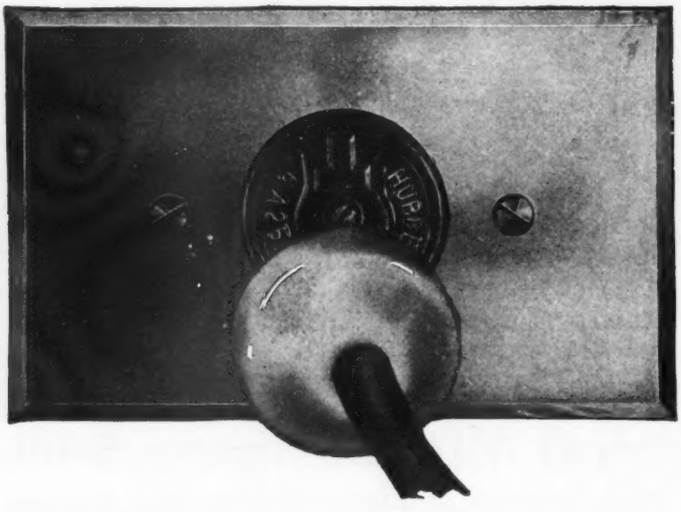
### BYE—and—BYE



That's what purchasers of Hubbell Standard Plugs and Receptacles do—they buy and buy—more.

Hubbell Standard Plugs and Receptacles are so convenient and trustworthy with their Interchangeable Cap and Concealed Contacts, so superior in every way that they are demanded whenever more plugs and receptacles are needed.

Dealers and Contractors: Repeat Orders are a great source of profit. They make for a quick turnover of stock with its direct financial benefit besides binding customers to you by the ties of confidence and good will. Hubbell devices always produce this very desirable sort of "come-back."



**Hubbell Receptacles are made to take all types of Hubbell Interchangeable Caps.**

## HARVEY HUBBELL, Inc., Bridgeport, Conn.

# THE ELECTRIC STORAGE BATTERY CO.

## The Big Telephone and Telegraph Companies

long ago *proved* the value of E. S. B. Co. Storage Batteries for their special needs.

Today, in **this** service, E. S. B. Co. Batteries dominate by a very large margin.

E. S. B. Co. Batteries are made for every storage battery purpose—their prestige among prominent electrical engineers is nation-wide.

**E. S. B. Co. Batteries Are Used**

By Central Lighting and Power Companies.
For small Isolated Lighting and Power Plants.
By Telephone and Telegraph Companies and for Wireless
For Mining Locomotives, Railway Car Lighting.
Switch and Signal Service, Battery Street Cars, etc.
For Electric Pleasure and Commercial Vehicles.
For Industrial Trucks and Tractors.
For Automobile Starting and Lighting.

**Our nearest sales office will send you practical bulletins on request**

**THE ELECTRIC STORAGE BATTERY CO.**

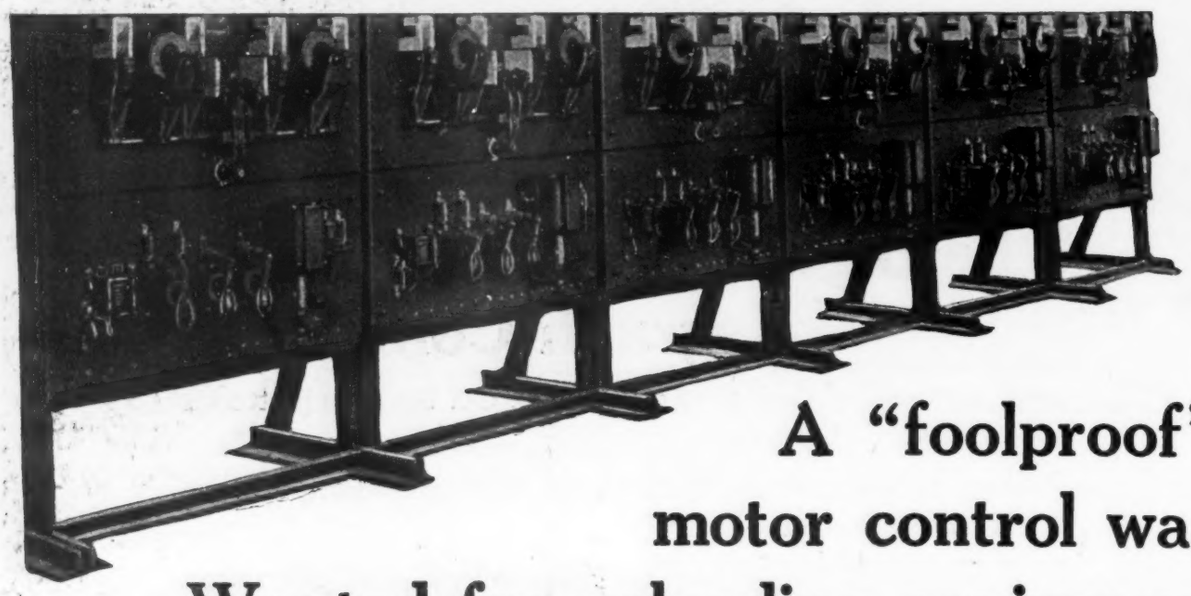
**The oldest and largest manufacturer of storage batteries in the world**

1888 PHILADELPHIA, PA. 1918

| | | | |
|---|---|---|---|
| New York | Boston | Chicago | Washington |
| Denver | San Francisco | St. Louis | Minneapolis |
| Cleveland | Atlanta | Kansas City | Pittsburgh |
| Detroit | Rochester | Toronto | |

"Exide", "Hycap-Exide", "Ironclad-Exide", "Thin-Exide"
"Chloride Accumulator", "Tudor Accumulator"

# SUNDH'S
## SPECIAL PANELS
*built to meet the requirements of a good specification*



## A "foolproof" motor control was Wanted for unloading equipment

The case was that of a ship loading and unloading device installed on an important pier.

It was necessary that this apparatus should be handled by rough and careless "dock wallopers." Consequently a motor control equipment was required that would be practically foolproof—an equipment, in fact, that would enable the owners to forget the human element altogether.

The illustration shows a few of the 34 special Full Magnet Control Reversible with Dynamic Brake and Overload equipments supplied by us to meet the above requirements.

Ask SUNDH service to solve YOUR motor control problem.

## —so they put it up to SUNDH

**Sundh Electric Co.**

**Ave. C & Parkhurst St., Newark, N. J.**
**New York Office: 51 E. 42nd St.**

First National Bank, Pittsburgh, Pa.
H. J. Kaufman, Peoples Gas Bldg., Chicago, Ill.

***Send Us Your Specifications***

**How Much Does a Motor Burnout Cost You?**

Not only the cost of rewinding the coils—that, probably is the least cost.

The *delay* — the annoying interruption—that's what costs most. And it's not only slowing up on the work but it's the wear and tear on the *men* doing the work that makes a motor burnout expensive.

And that's why so many manufacturers insist on having

# ROLLER-SMITH

**Industrial Circuit Breakers For Continuous Service**

They give maximum protection. A slight kick from the armature—and the breaker flies open. And there is practically no interruption in the shop.

Supplied in overload, under load, no-voltage, shunt-trip and reverse current types and combinations. Get Bulletin No. 71.

**Roller-Smith Company**

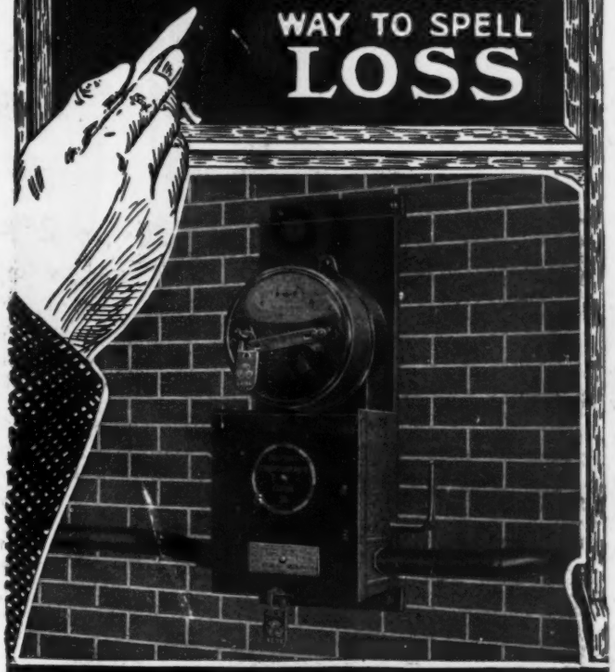
**233 Broadway, New York**

CHICAGO Monadnock Block — Works Bethlehem, Pa. — CLEVELAND Williamson Bldg.

BUFFALO.....716 Ellicott Sq.
DENVER.....1633 Tremont St.
PHILADELPHIA.....Drexel Bldg.
PITTSBURGH..Union Arcade Bldg.
SALT LAKE CITY, Walker Bank Bldg.
SAN FRANCISCO, 589 Howard St.
SEATTLE.....538 First Ave., S.
ST. LOUIS. Railway Exchange Bldg.

# TAMPERING

JUST ANOTHER WAY TO SPELL **LOSS**



**METROPOLITAN-PROTECTIVE-DEVICES-**

JUST ANOTHER WAY TO SPELL ECONOMY

## Consider These Advantages

**Tamperproof and Foolproof Features**
**Safeguarding of Revenue**
**Continuity of Service**
**Prevention of Unauthorized Interference**
**Safety to Life**
**Elimination of Fire Hazard**
**Uniformity of Service Equipment**
**Accessibility for Repairs and Tests**
**Economy of Installation Expenses**
**Prevention of Overfusing**

## Now Try Them And Be Convinced

METROPOLITAN ENGINEERING COMPANY
1250 Atlantic Ave. Brooklyn, N.Y.
Canadian Representative: Metropolitan Engineering Co., Ltd. 50 Sherbourne Street, Toronto, Canada

# Some of the Ward Mounted

All WARD LEONARD Resistance Units are wound on a substantial porcelain tube—the terminal connections are made mechanically and electrically perfect—and the entire unit, including the joint between terminal connections and resistance wire, is then hermetically sealed by the vitreous enamel insulation—free from any corroding, or electrically-destructive influences.

**Ward Leonard Electric Company**

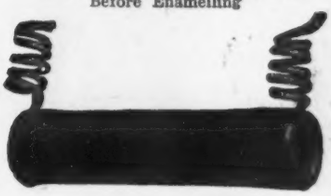
Mount Vernon, New York

Westburg Engineering Co.—Chicago
Wm. M. Tompkins—Philadelphia
The Walter P. Ambos Co.—Cleveland
Sperry & Bittner—Pittsburgh

# Types of Leonard

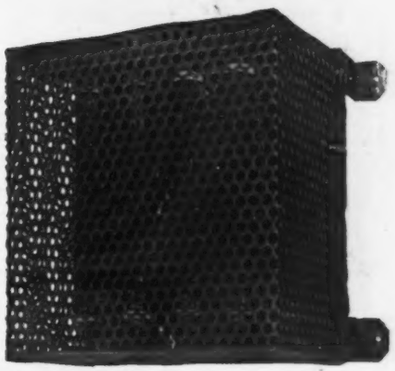
## Resistance Units with Vitreous Enamel Insulation

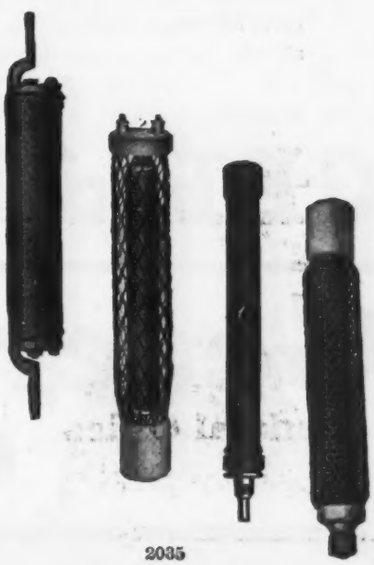
Ward Leonard Resistance Unit
Before Enamelling



After Enamelling

You have some problem in mounting your resistance units. Why not consult us?





**Ward Leonard Electric Company**

Mount Vernon, New York

Electrical Specialties Co.—Detroit

Morse Engineering Co.—St. Louis
Electric Material Co.—San Francisco

2035

*Add standardized equipment to standardized methods. It can produce capacity output.*

## Safety at all times

First of all, G-E Truck Type Switchboard Units are safe. They eliminate personal hazard to an exceptional degree.

Where special precautions to insure personal safety must be taken, as in mines and industrial plants, these units have proven the most desirable switchboard panels yet developed.

Complete enclosure, as illustrated, of all current-carrying parts within the steel compartment, affords personal protection and reduces fire risk.

The movable truck carries all the instruments, switching and protective devices. By mounting this equipment on a truck that cannot be withdrawn until all this apparatus is dead, electrically, inspection is easy and safe.

With a spare truck of proper capacity it is a matter of minutes to substitute a panel in case of trouble and to maintain practically continuous service.

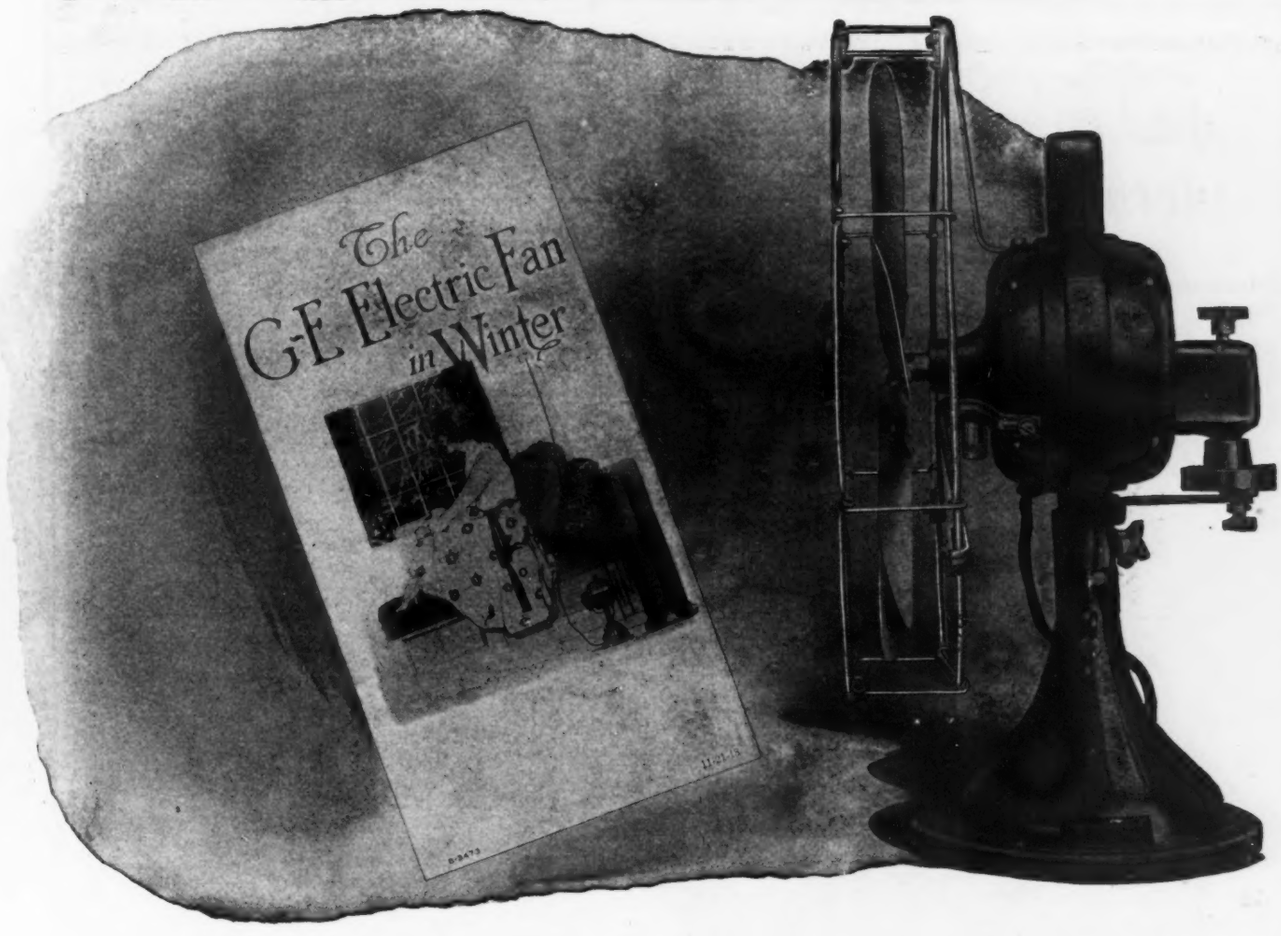
Consult the G-E Switchboard Specialist in your vicinity. Write our nearest office.

44-13

**G-E Truck Type Switchboard Units**

**General Electric Company**

General Office Schenectady, N.Y.




# Fans As Winter Dayload Builders

The same fan that furnishes cooling breezes in summer is equally useful in winter as a heat distributor.

Central stations will find it profitable to push the winter uses of fans on their lines while customers will realize a fuel saving far in excess of the cost of the current.

# Some Publicity Suggestions

have been prepared for stimulating the winter use of fans. They will be furnished to any central station on request.

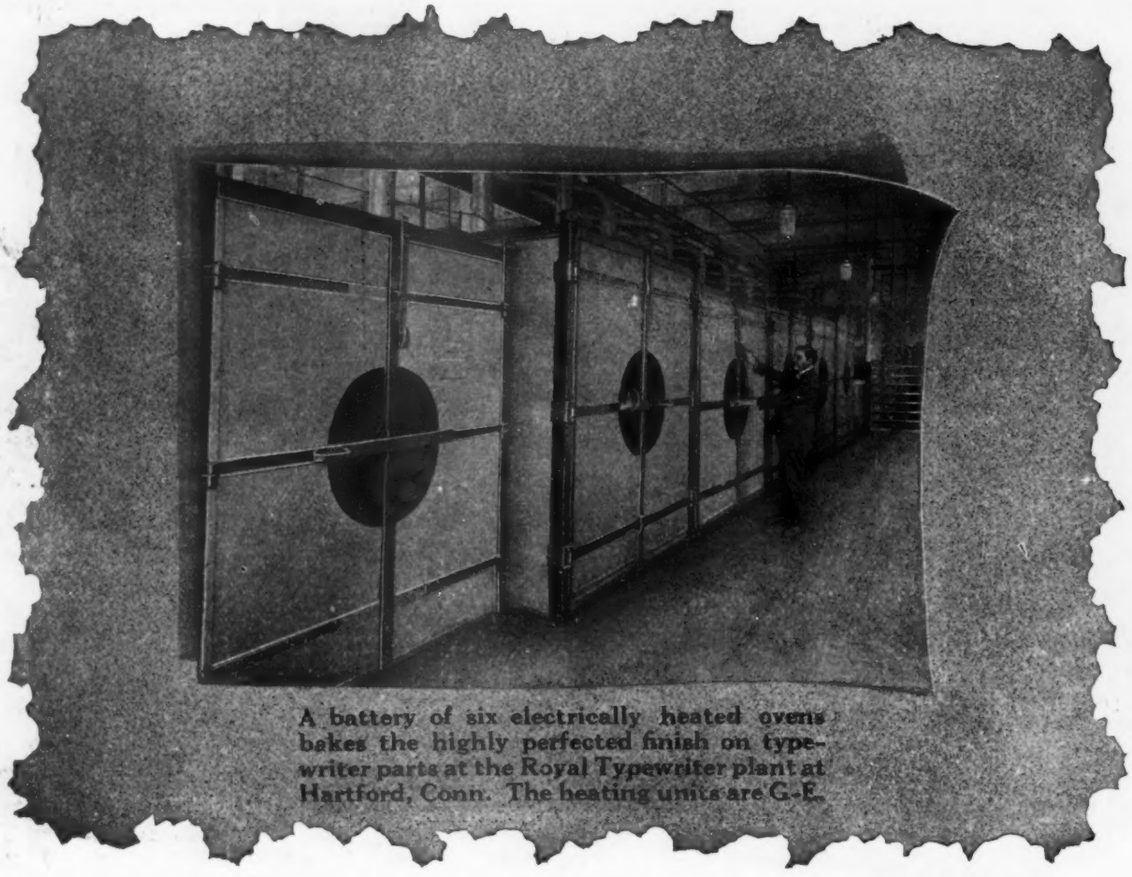
As an all-year-'round utility, the electric fan will become an easier seller and a better dayload builder for the central station. Any publicity given fans at this season will prove profitable not only from a standpoint of current-consumption but also as a good-will builder

*Ask us for further details*

12B-18

**General Electric Company**

General Office Schenectady, N.Y.



A battery of six electrically heated ovens bakes the highly perfected finish on typewriter parts at the Royal Typewriter plant at Hartford, Conn. The heating units are G-E.

# Baking the Perfect Finish

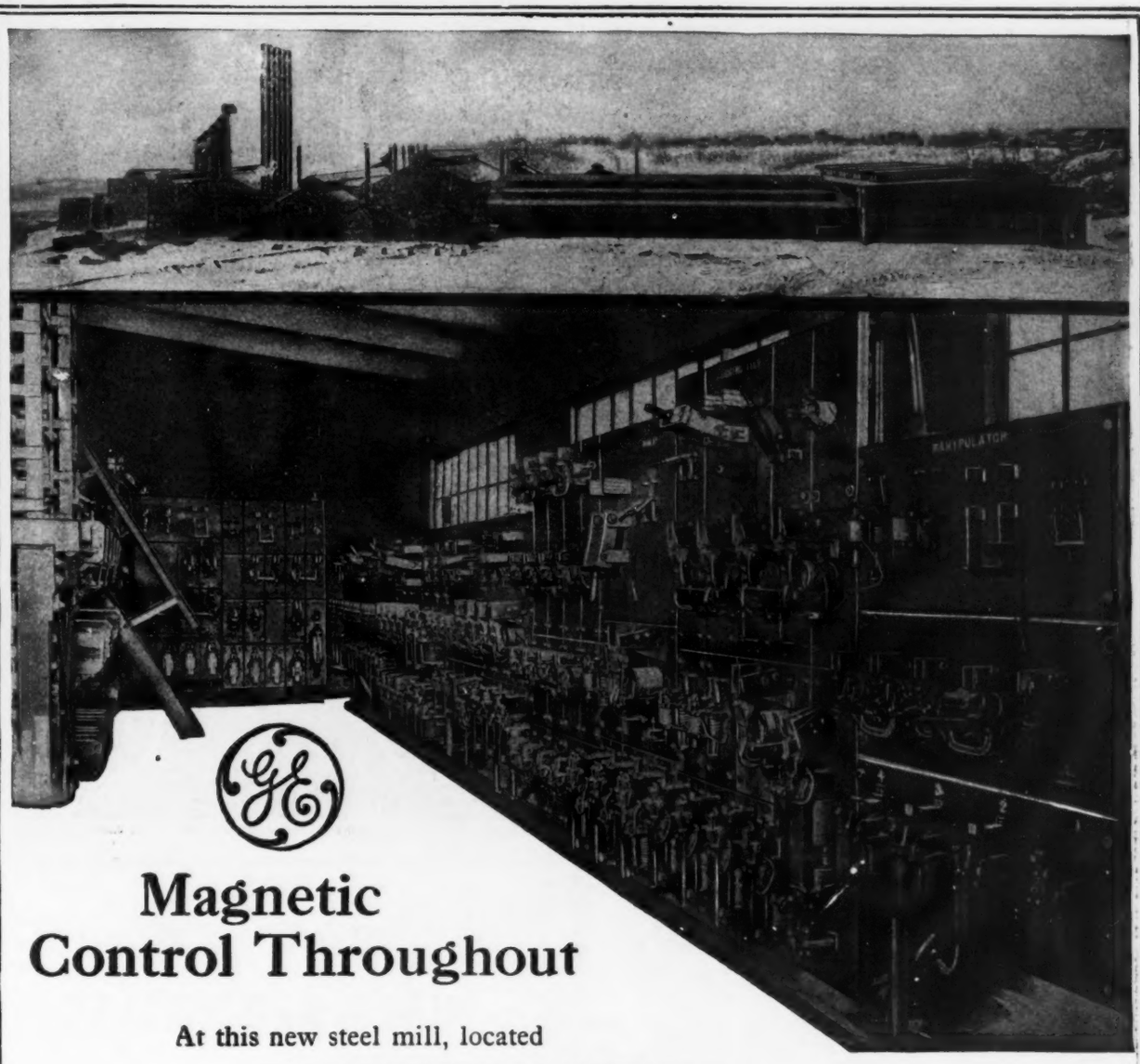
Electric heat is to be preferred where the finish on the product must be of unusual brilliance and durability. This result is obtained by the clean, radiant heat, the practically perfect method of ventilation permissible and the absolute control of temperatures possible in

# Electrically Heated Ovens

Our industrial heating specialists are prepared to advise manufacturers on the proper steps to take in equipping existing ovens with electric heating units. This service will be made available by an inquiry to our nearest office.

**General Electric Company**

General Office Schenectady, N.Y.



# Magnetic Control Throughout

**At this new steel mill, located**

**"SOMEWHERE IN AMERICA,"**

safety is evident at every turn. G-E magnetic control apparatus, located on the walls or in separate rooms, is operated at the machine by simply pressing a button or moving a master switch handle.

The ease with which the machine is controlled permits the operator to give his undivided attention to production.

RELIABILITY is evidenced by the fact that this new mill with hundreds of interdependent electrically operated mechanisms has never recorded a delay due to failure of control equipment.

**General Electric Company**

General Office Schenectady, N.Y.

43-A-13

KERITE
AN INVESTMENT
When you put your money into KERITE you make an investment in service. You do more than buy conductors, insulation and protection. You obtain the best possible combination of the most desirable qualities in permanent form.
KERITE remains long after the price is forgotten.
KERITE INSULATED WIRE & CABLE COMPANY

PARANITE
RUBBER COVERED WIRES & CABLES
If its PARANITE its right
More than meets code requirements
Underground, Aerial, Submarine and Inside Use. Telephone, Telegraph, Fire Alarm, Electric Light and Power Wires and Cables
THE BEST FOR EVERY PURPOSE
INDIANA RUBBER & INSULATED WIRE CO.
JONESBORO, IND.
CHICAGO BRANCH:
210 S. DESPLAINES ST
EASTERN REPRESENTATIVES:
THOMAS & BETTS CO 105 HUDSON ST., N.Y.

# Manson Tape

The Standard for Friction Tapes

## FOR 35 YEARS

Friction Tape values have been measured by the standard established by MANSON TAPE.

MANSON TAPE is a rubber filled cloth tape for protecting joints in insulated wires against mechanical injury. It is adhesive, does not unwrap and does not corrode copper wire. Put up in neat tin boxes keeping the tape clean and avoiding waste.

**Manufactured EXCLUSIVELY by**

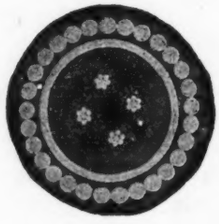
**The Okonite Company**

**501 Fifth Avenue, New York**

Central Electric Company, Chicago, Ill., Gen'l Western Agents

F. D. Lawrence Elect. Co. Cincinnati, O. | Pettingell-Andrews Co. Boston, Mass. | Novelty Elect. Co. Philadelphia, Pa.

## SIMPLEX
## WIRES AND CABLES



INSULATED WITH

**RUBBER**

**CAMBRIC**

OR

**PAPER**

SIMPLEX WIRE & CABLE Co

MANUFACTURERS

201 DEVONSHIRE ST. BOSTON

CHICAGO SAN FRANCISCO

# Two Tremendous Years
## for the Electrical Industry
## 1918-1919

That 1918 has witnessed developments that have pushed the industry forward at a speed which might not have been attained in a decade without the stimulus of war is evident. This rapid progress has been made in every department of the industry. Invention, manufacture, organization of resources for public service, wider application of energy, higher efficiencies in generation and transmission.

Forced by the stress of war most of this greater knowledge has been applied exclusively to the needs of war. 1919, however, will be a year of tremendous activity in the adaptation of these processes to the requirements of peace, a year in which the progress so rudely forced by war will be capitalized.

1919 will be a year of change and adaptation. A year of tremendous opportunities. A year of rapid evolution. A year in which the industrial and commercial revolutions that war has brought will be crystallized in the regular processes of normal business.

The industry will profit from these great opportunities precisely in ratio to the breadth of vision and spirit of progress that is applied to their utilization.

**Electrical World**

*"The Voice of the Industry"*

# Directory of Engineers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Research Engineer
Processes — Electrical
Inventions — Chemical
Special Machinery — Mechanical
Laboratory, Wilton, N. H.

**HUGH L. COOPER & CO.**
General Hydraulic Engineering, including the design, financing, construction and management of hydro-electric power plants.
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CONSULTING AND DESIGNING
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870 Woodward Ave. Detroit, Mich.

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Consulting Engineer
Illumination, Management and Operation of Electric Light and Power Companies.
Telephone, Randolph, 7184
140 South Dearborn Street Chicago

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Incorporated.
Power and Industrial Plants
Reports—Design—Construction
120 Broadway, New York

**ALPHA ELECTRICAL LABORATORY**
Build and install special machinery and entire plants for manufacture of incandescent lamps—especially nitrogen types. Maintain complete demonstration and research laboratory with nitrogen refining outfits, winding machines, etc. Special lamps developed.
Glass Blowing. Vacuum Work.
178 Mott St., New York City.

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Electrical and Mechanical Laboratories
Tests of Electrical Machinery, Apparatus and Supplies. Materials of Construction. Coal, Paper, etc. Inspection of Material and Apparatus at Manufactories.
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Investigations. Appraisals.
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HYDRAULIC ENGINEERS
Specialize in the Design of Power Plants and DAMS ON SOIL FOUNDATIONS

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Consulting Engineer
ENGINEERING ORGANIZATION AND DESIGN
Specialist in Electrical Power Switching and Protective Equipment, Industrial and Railway Control and Brake Equipment.
615 77th Street, Brooklyn, N. Y.

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Consulting Engineer
Gas and Electric Plants
Design, Construction and Operation
Valuations and Reports
People's Gas Building, Chicago

YOUR card in this space will be read by men in need of engineering services—a larger number of them than are reached by any other publication

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### 125 VOLT D. C. GENERATORS

| Kw. | | Speed |
|---|---|---|
| 1 12 | Gen. Elec., interpole, type CVC | 1800 |
| 1 12½ | Fisher | 800 |
| 1 14 | National, direct connected to Ideal hor. self-oiling auto. center-crank engine | 350 |
| 1 25 | Northern | 1050 |
| 1 25 | Gen. Elec. | 1035 |
| 1 25 | Northern | 750 |
| 1 30 | Crocker-Wheeler | 800 |
| 1 30 | Gen. Elec. | 1000 |
| 1 35 | Westinghouse "S" | 725 |
| 1 40 | Gen. Elec. 6-pole to Ideal latest type engine | 300 |
| 1 45 | Western Elec. | 500 |
| 1 65 | C. & C. | 650 |
| 1 65 | Crocker-Wheeler | 625 |
| 1 75 | Ridgway, direct connected to McEwen engine | 250 |
| 1 100 | National, 6-pole | 615 |
| 1 100 | Westinghouse, direct connected to Harrisburg tandem-compound engine | 275 |

### 250 VOLT GENERATORS

| Kw. | | Speed |
|---|---|---|
| 1 15 | Chandeysson, MP, comp, 125-250 v., 3-wire DeLaval single stage non-condensing turbine (125-lb. steam pressure) | 2000 |
| 1 20 | Sprague, DeLaval single-stage steam turbine, for 150-lb. steam pressure | 2000 |
| 1 25 | Northern | 1050 |
| 1 25 | Westinghouse, Ball & Wood hor. engine | 350 |
| 1 40 | Western Elec. | 1150 |
| 1 40 | Sprague, 125-250 v., 3-wire | 1050 |
| 1 50 | Commercial | 775 |
| 1 50 | C. & C., Type "S" | 600 |
| 1 55 | Ft. Wayne, 125-250 v., 3-wire | 950 |
| 2 62½ | Allis-Chalmers | 450 |
| 1 75 | Morgan-Gardner | 725 |
| 1 75 | Northern | 650 |
| 1 100 | Goodman | 600 |
| 1 100 | Westinghouse | 350 |
| 1 100 | Gen. Elec. | 550 |
| 1 100 | Gen. Elec., to Buffalo Forge Co. engine | 260 |
| 1 125 | Westinghouse | 950 |
| 2 125 | Allis-Chalmers | 850 |
| 1 150 | Ft. Wayne | 650 |
| 1 200 | Westinghouse | 750 |
| 1 225 | Crocker-Wheeler, 6-pole, 3-bearing | 450 |

### 550 VOLT D. C. GENERATOR

| Kw. | | Speed |
|---|---|---|
| 1 200 | Westinghouse | 510 |

### 220 VOLT MOTORS

| H.P. | | Speed |
|---|---|---|
| 1 3 | Westinghouse | 1500 |
| 1 3 | Crocker-Wheeler | 1450 |
| 1 3 | Colonial | 1425 |
| 1 3 | Fairbanks-Morse | 1300 |
| 1 3 | Western Elec. | 1100 |
| 1 3 | Robbins & Myers | 900 |

| H.P. | | Speed |
|---|---|---|
| 1 3½ | Fairbanks-Morse, interpole | 1625 |
| 1 4 | Hertner | 1250 |
| 1 4 | Peerless | 1200 |
| 1 4 | Thompson-Ryan | 900 |
| 1 5 | Westinghouse, interpole | 2200 |
| 1 5 | Northern | 1600 |
| 1 5 | Fairbanks-Morse | 1500 |
| 2 5 | Crocker-Wheeler | 1400 |
| 1 6 | Western Elec. | 1600 |
| 1 6 | Bartz-Wygand & Brown | 1475 |
| 2 6 | Westinghouse | 1465 |
| 1 7½ | Colonial | 1575 |
| 1 7½ | Watson | 1350 |
| 1 7½ | Ideal, interpole | 1150 |
| 1 7½ | Sprague-Lundell | 1050 |
| 1 7½ | National | 1090 |
| 1 7½ | Gen. Elec. | 900 |
| 1 7½ | Browning | 875 |
| 1 7½ | Sprague-Lundell, comp, printing-press motor | 140 |
| 1 10 | Robbins & Myers | 2100 |
| 1 10 | Fairbanks-Morse | 1400 |
| 1 10 | Gen. Elec., C-20 | 1200 |
| 1 10 | Westinghouse S | 1050 |
| 1 10 | Crocker-Wheeler | 800 |
| 1 15 | Westinghouse S | 1500 |
| 1 15 | Fairbanks-Morse | 975 |
| 1 15 | Northern, vertical, on tripod | 400 |
| 1 20 | Crocker-Wheeler | 1200 |
| 1 20 | Jenney, vertical | 1000 |
| 1 20 | Jenney | 675 |
| 1 20 | Lincoln | 540 |
| 1 20 | C. & C., double-commutator, double-speed | 250-500 |
| 2 25 | Allis-Chalmers | 900 |
| 1 25 | Westinghouse, railway type, series, crane or hoisting motors, with reversible drum-controllers | 500 |
| 1 30 | Northern | 900 |
| 1 30 | Gen. Elec. | 965 |
| 1 30 | Fisher | 675 |
| 1 35 | Westinghouse, railway type, series, crane or hoisting motor with C-H reversible drum-controller | 550 |
| 1 40 | Fairbanks-Morse, interpole | 1000 |
| 1 40 | Northern | 550 |
| 1 40 | Westinghouse, variable speed, by-field control | 450-900 |
| 1 50 | Westinghouse | 800 |
| 1 60 | Ft. Wayne | 550 |
| 4 75 | Northern, new | 450 |
| 1 75 | Northern, comp | 400 |
| 4 75 | Allis-Chalmers, MP, comp | 325 |
| 1 100 | Northern, MP, comp | 500 |
| 1 125 | Westinghouse, 6-pole comp | 275 |
| 3 150 | Allis-Chalmers, MP, comp | 650 |

### 220 or 440 VOLTS

**Three Phase, 60 Cycle A.C. Motors**

| H.P. | | Speed |
|---|---|---|
| 2 ½ | Kimble | 1160 |
| 2 ½ | Kimble, slip-ring, variable speed, new, shop-worn, without controllers | 1160 |
| 2 1 | Gen. Elec., 110 v. | 1800 |
| 1 1 | Crocker-Wheeler | 1800 |
| 4 1 | Gen. Elec. | 1800 |
| 1 1 | Gen. Elec., Yeomans single stage centrifugal pump, (20 gals. per min. 15-ft. head) | 1800 |
| 1 1 | Westinghouse | 1725 |
| 1 1 | Westinghouse | 1700 |

| H.P. | | Speed |
|---|---|---|
| 2 1 | Allis-Chalmers | 1700 |
| 1 1 | Lincoln | 1200 |
| 5 1 | Gen. Elec. | 1200 |
| 1 1 | Westinghouse | 1120 |
| 1 1 | Holtzer-Cabot | 1120 |
| 1 2 | Kimble, variable speed with Kimble drum-type controller and resistance | 1750 |
| 1 2 | Westinghouse | 1120 |
| 1 2 | Gen. Elec | 300 |
| 1 3 | Gen. Elec. | 1800 |
| 1 3 | Westinghouse | 1700 |
| 1 3 | Kimble, slip-ring, variable speed, new, shop-worn, without controller | 1750 |
| 1 3 | Fairbanks-Morse | 1200 |
| 1 3 | Kimble | 1160 |
| 1 3 | Gen. Elec. | 1200 |
| 1 3 | Crocker-Wheeler | 1100 |
| 1 3 | Kimble, slip-ring, variable speed, new, shop-worn, without controller | 1160 |
| 2 5 | Howell Elec. Co. | 1800 |
| 1 5 | Diehl | 1735 |
| 2 5 | Richmond | 1720 |
| 1 5 | Gen. Elec. | 1800 |
| 1 5 | Westinghouse, type CX | 1700 |
| 2 5 | Kimble, slip-ring, variable speed, new, shop-worn without controllers | 1750 |
| 1 7½ | Fairbanks-Morse | 1800 |
| 1 7½ | Westinghouse | 1700 |
| 3 7½ | Gen. Elec. | 1800 |
| 3 7½ | Howell Elec. Co. | 1800 |
| 1 7½ | Westinghouse, vertical shaft, on pedestal | 1700 |
| 1 7½ | Howell Elec. Co. | 1200 |
| 1 7½ | Lincoln | 1200 |
| 1 7½ | Wagner | 1140 |
| 2 7 | Allis-Chalmers | 1130 |
| 3 7 | Westinghouse, type CX | 1120 |
| 3 7 | Westinghouse, type CCL | 1120 |
| 1 7 | Westinghouse | 850 |
| 2 7 | Fairbanks-Morse | 900 |
| 2 10 | Gen. Elec. | 1800 |
| 2 10 | Howell | 1800 |
| 2 10 | Westinghouse, type CS | 1740 |
| 1 10 | Westinghouse, type CCL | 1700 |
| 2 10 | Howell | 1800 |
| 2 10 | Richmond | 1720 |
| 2 10 | Howell | 1200 |
| 2 10 | Wagner | 1140 |
| 1 10 | Allis-Chalmers | 1130 |
| 2 10 | Howell Elec. Co. | 1200 |
| 1 10 | Richmond | 1120 |
| 1 10 | Gen. Elec., form L | 1200 |
| 4 10 | Gen. Elec. | 1200 |
| 2 10 | Robbins & Myers | 1150 |
| 2 10 | Westinghouse | 1110 |
| 1 10 | Gen. Elec. | 720 |
| 1 10 | Gen. Elec., type MT, var. speed, (continuous duty), slip-ring, with panel type controller | 600 |
| 1 10 | Gen. Elec., type MT, var. speed (continuous duty), slip-ring, with C. H. reversible drum controller and resistance | 600 |
| 1 11 | Lincoln | 1800 |
| 1 15 | Gen. Elec. | 3600 |
| 1 15 | Gen. Elec. | 1800 |

### 220 or 440 VOLTS

**Three Phase, 60 Cycle A.C. Motors**

| H.P. | | Speed |
|---|---|---|
| 1 15 | Howell | 1200 |
| 1 15 | Gen. Elec., form L (wound rotor) | 1200 |

| H.P. | | Speed |
|---|---|---|
| 2 15 | Gen. Elec., form K | 1200 |
| 1 15 | Western Elec | 1145 |
| 1 15 | Richmond | 1140 |
| 1 15 | Westinghouse, type CX | 1120 |
| 2 15 | Westinghouse, type CCL | 1120 |
| 1 15 | Gen. Elec., form K | 900 |
| 1 15 | Allis-Chalmers | 900 |
| 2 15 | Gen. Elec., form M (intermittent duty), slip ring, variable speed, with Bulletin 7075 Union panel-type controller | 900 |
| 1 15 | Allis-Chalmers (continuous rating) 220 or 440 v. slip-ring, variable speed, with Union Bulletin No. 7075 panel type controller | 600 |
| 1 20 | Howell | 1800 |
| 3 20 | Gen. Elec. | 900 |
| 2 20 | Gen. Elec., form K | 1200 |
| 1 20 | Fairbanks-Morse | 900 |
| 3 20 | Allis-Chalmers | 850 |
| 1 20 | Westinghouse, type CS | 860 |
| 1 20 | Allis-Chalmers | 575 |
| 1 25 | Gen. Elec. | 1800 |
| 2 25 | Gen. Elec., type K | 1200 |
| 7 25 | Gen. Elec., type KT, form B | 900 |
| 1 30 | Fairbanks-Morse | 1800 |
| 1 30 | Westinghouse, type CX | 1120 |
| 1 30 | Gen. Elec., form A | 900 |
| 6 40 | Westinghouse, type HF, slip-ring, constant speed with starter | 850 |
| 1 50 | Gen. Elec., Union Pump Co. centrifugal pump, 10 in. intake, 8 in. discharge capacity 1600 gals. per min., 75 ft. head | 1750 |
| 1 50 | Gen. Elec., form K, 2200 v | 1200 |
| 1 50 | Lancashire, 220 or 440 v. | 1140 |
| 2 50 | Westinghouse, type CCL, 220v. | 1120 |
| 6 50 | Gen. Elec., type I, form M, 220 or 440 v., slip-ring, constant speed, with panel type starter | 1200 |
| 6 50 | Gen. Elec., type I, form M, 220 or 440 v., slip-ring, variable speed, with panel type controller | 1200 |
| 1 50 | Gen. Elec., type KT, form B | 900 |
| 1 50 | Westinghouse, type CI, slip-ring, intermittent (30 min.) rating, 220 or 440 v., variable speed, with reversible drum-controller and resistance | 490 |
| 1 75 | Gen. Elec., form M, (continuous duty), 220 or 440 v., variable speed, slip-ring, with G. E., type T10S, form A, non-reversible drum controller and grid resistance | 900 |
| 1 100 | Westinghouse, type CX | 690 |
| 1 125 | Gen. Elec., form A, (wound rotor) | 600 |
| 1 150 | Gen., Elec., form L, (wound rotor) | 600 |
| 2 150 | Westinghouse, type CCL, 2200 volts | 450 |
| 2 160 | Gen. Elec., type ATI, form S, synchronous, with type CR starters, 2200 v. | 720 |
| 1 250 | Westinghouse, type CX, 220 or 440 volts | 580 |

# RELIABLE NEW AND USED
# POWER PLANT MACHINERY

## MOTORS A. C.

### 3 Phase, 60 Cycle, Slip Ring Type

| H.P. | Make | Volts | R.P.M. |
|---|---|---|---|
| 1— | 10 New General Electric | 220 | 1200 |
| 2— | 25 New General Electric | 440 | 1200 |
| 1— | 40 New General Electric | 440 | 900 |
| 1— | 50 New Allis-Chalmers | 440 | 900 |
| 1— | 75 New General Electric | 440 | 900 |
| 1— | 100 New General Electric | 440 | 720 |
| 2— | 150 New General Electric | 440 | 720 |
| 1— | 200 Used Allis-Chalmers | 440 | 600 |

## STEAM ENGINES

1—150 H.P. 16 x 18 Erie City
1—150 H.P. 15 x 14 Ideal Automatic
1— 53 to 106 H.P. 12 x 30 Lane & Bodley
1— 75 to 100 H.P. 12½ x 18 Atlas Automatic
1— 90 H.P. 14 x 21 Lane & Bodley
1— 60 H.P. 9 x 16 Brownell Automatic
1— 35 H.P. 10 x 14 Chandler & Taylor
1— 30 H.P. 9 x 12 Nagle
1— 16 H.P. 7½ x 14 Brownell
1— 8 H.P. 6 x 8 Clark vert.
1— 4 H.P. 4 x 5 Clark vert.

## BOILERS

3—164 H.P. Sterling Water Tube
2—150 H.P. 72 x 18 high pressure
2—125 H.P. 72 x 16 high pressure
1—100 H.P. 66 x 16 high pressure
2—100 H.P. 66 x 16 standard
1—100 H.P. Locomotive firebox type'—
1— 80 H.P. 60 x 16 standard
1— 70 H.P. 54 x 16 standard
1— 70 H.P. 54 x 14 vertical
1— 60 H.P. Locomotive firebox type
1— 50 H.P. 48 x 16 standard
1— 40 H.P. Locomotive or firebox
1— 35 H.P. 48 x 14 Scotch Marine
1— 20 Locomotive firebox type
1— 15 H.P. Erie City "Economic"

## ALTERNATING CURRENT GENERATORS

### 240 to 2300 Volts

1—200 Kw. General Electric, 3 phase, 60 cycle, 2300 volts, 600 R.P.M. revolving field Alternator, with direct connected exciter
1—150 Kw. General Electric form D, type ATB., 3 phase, 60 cycle, 220 volts, 600 R.P.M. revolving field Alternator with compensating armature exciter on shaft
2—125 Kw. each, 3 phase, 60 cycle, 220 volts, engine type, revolving field Allis-Chalmers Alternators, each direct connected to a 14½ x 18 Buckeye Automatic Engine with switchboard and instruments
1—90 Kva. Electric Machinery Company 3 phase, 60 cycle, 2200 volts, 1200 R.P.M. revolving field Generators
1—85 Kw. Allis-Chalmers single phase, 60 cycle, 2200 volts, 900 R.P.M. revolving field Alternators

## MOTORS A. C.

### 3 Phase, 60 Cycle, Squirrel Cage

| H.P. | Make | Volts | R.P.M. |
|---|---|---|---|
| 1— | 2 Rebuilt Triumph | 220 | 1800 |
| 3— | 2 New General Electric | 220 | 1800 |
| 5— | 3 New General Electric | 220 | 1800 |
| 5— | 5 New General Electric | 220 | 1800 |
| 4— | 5 New General Electric | 220 | 1200 |
| 5— | 7½ New General Electric | 220 | 1800 |
| 2— | 7½ New General Electric | 220 | 900 |
| 2— | 10 New General Electric | 220 | 1200 |
| 2— | 15 New General Electric | 220 | 1200 |
| 2— | 20 New General Electric | 220 | 1800 |
| 4— | 20 New General Electric | 220 | 1200 |
| 3— | 20 New General Electric | 220 | 900 |
| 4— | 25 New General Electric | 220 | 1200 |
| 1— | 25 New Allis-Chalmers | 220 | 580 |
| 2— | 30 New General Electric | 220 | 1200 |
| 2— | 30 New General Electric | 220 | 900 |
| 1— | 40 New General Electric | 220 | 1200 |
| 1— | 40 New General Electric | 220 | 900 |
| 4— | 50 New General Electric | 220 | 900 |
| 4— | 75 New General Electric | 220 | 900 |
| 1— | 100 New General Electric | 220 | 900 |
| 1— | 150 Used Westinghouse | 220 | 1120 |

(Above motor can also be furnished as 2 phase, Any of these A. C. Motors can be furnished suitable for 440 volts

## DIRECT CURRENT MOTORS

### 120-220-250-500 Volts

| H.P. | Make | Volts | R.P.M. |
|---|---|---|---|
| 1— | 100 Rebuilt Allis-Chal. | 230 Sh. Wd. | 650 |
| 1— | 55 Rebuilt G. E. | 220 Sh. Wd. | 900 |
| 1— | 50 Rebuilt Allis-Chal. | 550 Sh. Wd. | 800 |
| 1— | 30 Rebuilt G. E. | 250 Cp. Wd. | 975 |
| 1— | 30 Rebuilt Northern | 220 Cp. Wd. | 600 |
| 1— | 25 Rebuilt Fisher | 250 Sh. Wd. | 650 |
| 1— | 25 Rebuilt G. E. | 250 Sh. Wd. | 975 |
| 1— | 10 Rebuilt Jantz & Leist | 220 Sh. Wd. | 900 |
| 4— | 7½ Rebuilt Allis-Chal. | 120 Sh. Wd. | 1700 |
| 1— | 3 Rebuilt Triumph | 230 Sh. Wd. | 1500 |

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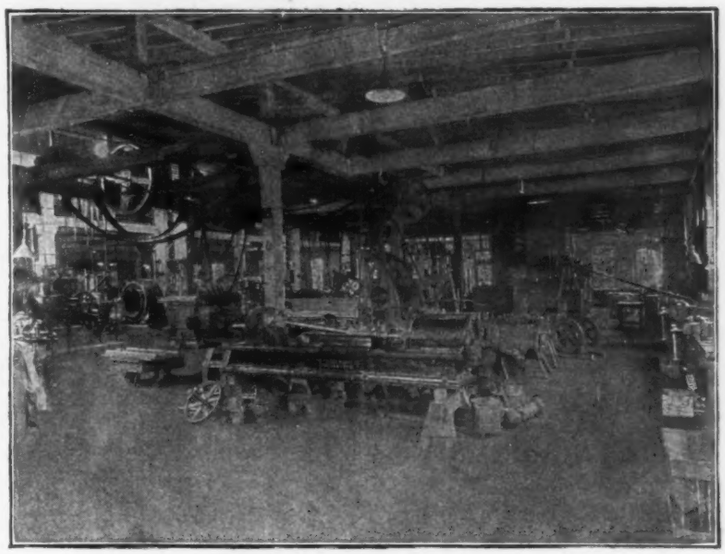
2—Allis-Chalmers 41.6 amperes, 120 volts D.C. Generators, at 1700 R.P.M. mounted on same base with and direct connected to motors of same size and type
1—25 Kw., 120 volts, D.C. Allis-Chalmers Generator at 850 R.P.M. mounted on same base with and direct connected to a 40 H.P. Allis-Chalmers 3 phase, 60 cycle, 220 volts induction motor
1—37½ Kw. Lincoln 115 volt, 900 R.P.M., D.C. Generator mounted on same base with and direct connected to a 60 H.P. Lincoln 3 phase, 60 cycle, 220 volt induction motor
1—New 150 Kw. General Electric 275 volts, 1200 R.P.M., D.C. Generator mounted on same base with and direct connected to a G. E. 225 Kva., Type ATI, 3 phase, 60 cycle, 2300 volts, 1200 R.P.M. Synchronous motor with 2 panel switchboard and instruments for controlling



Another view in the shops back of the goods

## DIRECT CURRENT GENERATORS

1—5 Kw. Allis-Chalmers, 120 volts, D.C., 1350 R.P.M. compound wound, 41.6 amperes Generator

1—5 Kw. Triumph, 120 volts, 1400 R.P.M., compound wound D.C. Generator with switchboard and instruments

1—10 Kw. Triumph, 120 volts, 1150 R.P.M., 80 amperes, compound wound D.C. Generator with switchboard and instruments

1—40 Kw. Fairbanks-Morse, 220 volts, direct current, 900 R.P.M., compound wound Generator

1—50 Kw., 125 volts, 6 pole D.C. Ft. Wayne Generator, direct connected to a 11 x 14 Buckeye Automatic Engine, with switchboard

## DIRECT CURRENT GENERATORS, Cont.

1—50 Kw. Allis-Chalmers, 240 volts, 208 amperes 275 R.P.M., D.C. Generator, direct connected to a 11½ x 12 Skinner Automatic self-oiling Engine, with switchboard and instruments. Can also be furnished with two 4 Kw., 110 volt Motor Generator Sets for a 110 volt circuit

1—75 Kw. Allis-Chalmers, 240 volts, 312.5 amperes, 275 R.P.M., D.C. Generator, direct connected to a 14 x 15 Skinner Automatic Engine, complete with same equipment as outfit mentioned above

1—100 Kw., G. E., 250 volts, D.C. compound wound Generator, direct connected to a 14½ x 16 Buckeye Automatic Piston Valve Engine, with switchboard and instruments for controlling.

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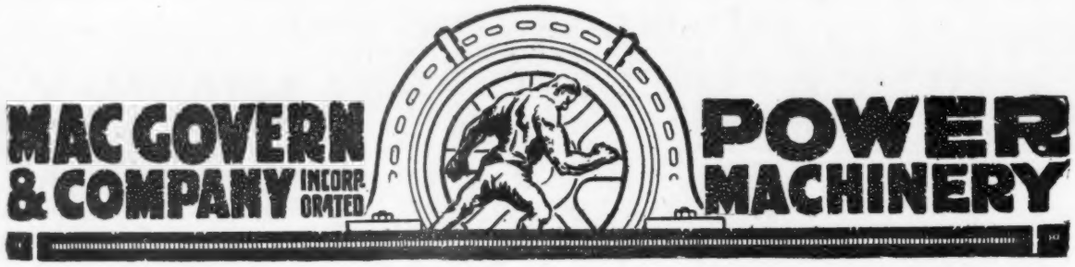
# THE RANDLE MACHINERY COMPANY

(ESTABLISHED 34 YEARS)

LOCATED ONLY AT **1822 Powers Street, CINCINNATI, OHIO**




# PROMPT SHIPMENT FROM STOCK

## TURBO-GENERATOR UNITS

### 60 Cycle

1—1250 Kw. Westinghouse-Parsons horizontal turbo-unit, 3 phase, 2300 volts, 3600 r.p.m., with LeBlanc jet type condenser and turbine driven pumps.

1—750 Kw. General Electric-Curtis horiz. turbo unit, 3 phase, 2300 volts, 3600 r.p.m. mixed pressure, with C. H. Wheeler surface condenser, vacuum and circulating pumps, etc.

2—625 Kva. Westinghouse-Parsons horiz. turbo units, 3 phase, 440 volts, 3600 r.p.m., non-condensing.

1—550 Kw. Gen. Elec.-Curtis, vertical, non-condensing turbo-unit, 3 phase, 4600 or 2300 volts, 1800 r.p.m.

1—500 Kw. Gen. Elec.-Curtis vertical turbo-unit, 3 phase, 2300 volts, 1800 r.p.m.

1—500 Kw. Allis-Chalmers horizontal turbo-unit, 3 phase, 480 volts, 3600 r.p.m., with Allis-Chalmers jet condenser and necessary pumps.

2—500 Kw. Units, Gen. Elec.-Curtis horizontal, 3 phase, 2300 volts, 3600 r.p.m., with switchboards and C. H. Wheeler surface condensers, each, 1400 sq.ft., with pumps.

## OIL ENGINE UNITS

### Alternating Current

1—300 Kw. Gen. Elec., 3 phase, 60 cycle, 600 volts, type ATB, form D, 44 pole, 164 r.p.m., dir. conn. to two 225 hp. Diesel oil engines, 16 in. x 24 in., complete with switchboard, exciter, air bottles, pumps, etc. Generator can be reconnected for 440 or 220 volts, or rewound for 2300 volts. Unit in first-class condition and can be inspected on original foundation.

1—125 Kw. Gen. Elec., 3 phase, 60 cycle, 240 volts, type ATB, form M, 36 pole, 200 r.p.m., conn. to one 170 hp. Diesel type A-3 vertical oil engine, 3 cyl., 14 in. x 21 in., complete with compressor, air bottles, pumps, exciter and all accessories. This unit has been completely overhauled by the Mfr. and is ready for immediate shipment.

## OIL ENGINE UNITS

### Direct Current

1—160 Kw. Allis-Chalmers-Bullock, 250 volts, 6 pole, 160 r.p.m., dir. conn. to 16 in. x 24 in. Diesel 3 cyl., vertical oil engine, complete with compressor, air bottles, pumps, switchboard, etc. Can be reconnected for 125 volts or arranged 3-wire with balancer set. Unit completely overhauled and now dismantled and ready for immediate shipment.

2—150 Kw. Ft. Wayne, 250 volts, 8 pole, MPL, 165 r.p.m., each dir. conn. to a 225 hp. Diesel, 3 cyl. vertical oil engine, 16 in. x 24 in., each unit complete with compressor, air bottles, pumps, switchboard, etc. Can be reconnected for 125 volt or arranged 3-wire with balancer set. Units completely overhauled and now dismantled and ready for immediate shipment.

## WATER TUBE BOILERS

2—981 hp. Edgemoor, 235 lb. pressure.
1—450 hp. Heine, 170 lb. pressure.
1—380 hp. Stirling, 150 lb. pressure.
2—360 hp. Erie City, 160 lb. pressure.
1—310 hp. Stirling, 200 lb. pressure.
6—308 hp. Heine, 140 lb. pressure.
1—305 hp. Babcock & Wilcox, 160 lb. pressure.
12—264 hp. Babcock & Wilcox, 175 lb. pressure.
8—250 hp. Stirling, 160 lb. pressure.
1—212 hp. Babcock & Wilcox, 160 lb. pressure.
2—204 hp. Babcock & Wilcox, 160 lb. pressure.

## SURFACE CONDENSERS

1—8000 sq. ft. Alberger.
1—6000 sq. ft. Wheeler Condenser & Eng. Co.
1—4200 sq. ft. Alberger.
3—4000 sq. ft. Wheeler Condenser & Eng. Co.
1—2800 sq. ft. Wheeler Condenser & Eng. Co.
1—1500 sq. ft. C. H. Wheeler.
1—700 sq. ft. Wheeler Condenser & Eng. Co.
1—525 Frick.

## TRANSFORMERS

### 60 Cycle

4—1850 Kva. Westinghouse, 3 phase, 33,000 volts primary, 6000 volts, secondary, air blast, oil cooled.

4—350 Kva. Gen. Elec., single phase, type H, form RP, 33,000 volts prim., 13,200-12,780-12,540-12,210-11,880 6270-5940 volts sec., OI SC.

3—200 Kw. Gen. Elec., single phase, air-blast, 13,200 volts prim., 2300 volts sec.

1—250 Kva. Allis-Chalmers, single phase, OI SC, 220 volts prim., 480-240 volts sec.

2—150 Kva. Westinghouse, single phase, rotary type, oil cooled, 2300 volts prim., 382 volts sec.

3—100 Kva. Gen. Elec., single phase, OI SC, prim. volts 6600 with taps for 6435-6270-6105-5940 volts, sec. volts 1150-1092.

2—100 Kva. Westinghouse, single phase, OI SC, 22,000-11,000 volts prim., 220-234-248 volts sec.

1—100 Kw. Gen. Elec., single phase, OI SC, 6600-6300-6000 volts prim., 230-260 volts sec.

1—90 Kw. Westinghouse, single phase, oil cooled, 6600 volts prim., 2200 volts sec.

3—75 Kw. Westinghouse, single phase, OI SC, 22,000 volts prim., with taps for 21,000-20,000-19,000 volts, 440 volts sec.

1—75 Kw. Gen. Elec., single phase, type AB, 2250 volts prim., 375 volts sec.

3—50 Kva. Westinghouse, single phase, OI SC, 11,000 volts prim., 575 volts sec.

3—50 Kw. Gen. Elec., single phase, oil cooled, 12.00 volts prim., 240-480 volts sec.

1—50 Kw. Westinghouse, single phase, type OD, 2300 volts prim., 220-110 volts sec.

4—37½ Kva. Westinghouse, single phase, oil cooled, 11,000 volts prim., 575 volts sec.

3—30 Kw. Ft. Wayne, single phase, oil cooled, 2200-1100 volts prim., 220-440 volts sec.

1—30 Kva. Gen. Elec., single phase, oil cooled, 1040-2080 volts prim., 104-208 volts sec.

2—25 Kva. Westinghouse, single phase, OI SC, 11,000 volts prim., 575 volts sec.

1—25 Kva. Gen. Elec., single phase, oil cooled, 1100-2200 volts prim., 110-220 volts sec.
Also smaller sizes.

### 25 Cycle

3—300 Kva. Westinghouse, single phase, water cooled, 39,000 volts primdelta connection, 60,000 volts star connected, 240 volts sec.

3—185 Kva. Gen. Elec., single phase, type AB, oil cooled, 33,000 volts prim. (19,100 volt tap), 430 volts sec.

2—150 Kva. Westinghouse, single phase, oil cooled, 2300 volts prim., 382 volts sec.

7—100 Kva. Gen. Elec., single phase, type HR, 2200-1980 volts prim., 370-185 volts sec.

2—50 Kw. Gen. Elec., single phase, oil cooled, 6600-5940 volts prim., 230-460 volts sec.

1—30 Kw. Westinghouse, three phase, type OD, 2200 volts prim., 440-220-110 volts sec.

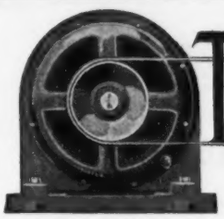
1—30 Kw. Gen. Elec., single phase, oil immersed, 2080-2300 volts prim., 230-460 volts sec.
Also smaller sizes.

**We shall be glad to mail complete list of Electrical, Steam and Hydraulic Machinery upon request.**

## MacGOVERN & COMPANY, Inc.

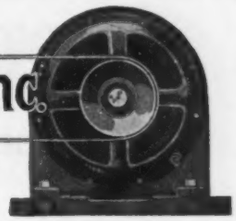
**114 Liberty Street, New York, N. Y.**

**Pittsburgh Office: 498 Union Arcade Building**



# TIFFANY HALL & CO., Inc.

ELECTRICAL EQUIPMENT - ENGINEERS
ALSO SPECIALISTS IN HEAVY AND DIFFICULT REPAIRS



# In Stock

## DIRECT CONNECTED UNITS

**1712**—One 300 kw., 220/440 volt, 150 r.p.m., 3 phase, 60 cycle Westinghouse revolving field alternator, direct connected to 18 and 30 x 24 Erie City cross compound 4-valve automatic engine, complete with belted exciter and switchboard panel. ..... Immediate

**1713**—One 150 kw., 220/440 volt, 225 r.p.m., 3 phase, 60 cycle Westinghouse revolving field alternator, direct connected to 12 and 21 x 18 Buckeye cross compound automatic engine, complete with belted exciter and switchboard panel. ..... Immediate

**1689**—One 16 kw., 250 volt, 350 r.p.m., Crocker-Wheeler direct current compound wound Generator, direct connected to a McEwen Engine. Complete. ..... Immediate

## MOTOR GENERATOR SETS

**1665**—One 250 kw., 550/600 volt, 720 r.p.m., D.C., compound wound interpole General Electric Generator, type DMC, on same base and direct connected to 360 hp., 2300 volt, 720 r.p.m., 3 phase, 60 cycle, General Electric synchronous Motor, type ATI, complete with appurtenances. ..... 2 weeks

**1538**—One 200 kw., 250 volt, 900 r.p.m. D.C. compound wound, interpole Allis-Chalmers Generator, with field rheostat, mounted on common cast iron sub-base, with 2300-volt, 3-phase, 60-cycle, synchronous, revolving field, self-starting Motor. Complete with starting apparatus. Can be reconnected for 440-volt operation. ..... Immediate

**1746**—One 100 kw., 250 volt, 850 r.p.m., direct current compound wound Westinghouse Generator, direct connected by flexible coupling to 150 hp., 440 volt, 3 phase, 60 cycle, Westinghouse Induction Motor. Set complete with field rheostat for generator and starter for motor. ..... Immediate

**1747**—One 85 kw., 125 volt, 850 r.p.m., direct current, compound wound, Westinghouse Generator, direct connected by means of a flexible coupling to 125 hp., 440 volt, 3 phase, 60 cycle, Westinghouse squirrel cage induction Motor, complete with field rheostat for generator and starter for motor ..... Immediate

## MOTORS

| Stock No. | Hp. | Volts | Speed | Phase | Cycles | Make and Type | Shipment |
|---|---|---|---|---|---|---|---|
| 1776 | 200 | 440/220 | 600 | 3 | 60 | Gen. Elec. Slip Ring | Immediate |
| 1673 | 150 | 2200 | 900 | 3 | 60 | Gen. Elec., Slip Ring | Immediate |
| 1608A | 150 | 440 | 900 | 3 | 60 | Westinghse. Sq. Cage | Immediate |
| 1673A | 150 | 550 | 900 | 3 | 60 | Gen. Elec. Slip Ring | Immediate |
| 1606A | 150 | 440 | 900 | 3 | 60 | Westghse. Sq. Cage | Immediate |
| 1673B | 150 | 220 | 900 | 2 | 60 | Gen. Elec. Slip Ring | Immediate |
| 1704 | 150 | 2200 | 720 | 3 | 60 | Gen. Elec. Slip Ring | Immediate |
| 1736 | 150 | 440/220 | 600 | 3 | 60 | Gen. Elec. Sq. Cage | Immediate |
| 1643 | 150 | 2200 | 600 | 3 | 60 | Gen. Elec. Slip Ring | Immediate |
| 1610A | 150 | 440/220 | 800 | 3 | 40 | Westinghse. Sq. Cage | 1 week |
| 1611A | 150 | 550 | 800 | 3 | 40 | Westghse. Sq. Cage | 1 week |
| 1644A | 125 | 2200 | 1200 | 3 | 60 | Allis-Chal. Sq. Cage | Immediate |
| 1644B | 125 | 440/220 | 1200 | 3 | 60 | Allis-Chal. Sq. Cage | Immediate |
| 1708 | 120 | 230 | 725 | D.C. | D.C. | Westghse. Type S | Immediate |
| 1572A | 100 | 220/440 | 1200 | 3 | 60 | Crocker-Wh. Sq. Cage | 1 week |
| 1738 | 100 | 440/220 | 720 | 3 | 60 | Gen. Elec. Sq. Cage | Immediate |
| 1567 | 100 | 440/220 | 720 | 2 | 60 | Gen. Elec. Sq. Cage | Immediate |
| 1556 | 100 | 220/440 | 600 | 3 | 60 | Westghse. Sq. Cage | Immediate |
| 1610 | 100 | 440 | 500 | 3 | 25 | Westghse. Sq. Cage | Immediate |
| 1611 | 100 | 440 | 500 | 3 | 25 | Westghse. Sq. Cage | Immediate |
| 1671 | 100 | 440 | 500 | 3 | 25 | Westghse. Slip Ring | Immediate |
| 1722A | 85 | 115 | 625 | D.C. | D.C. | Westghse. Cp.Wd. | Immediate |
| 1618 | 75 | 220/440 | 1200 | 3 | 60 | Gen. Elec., Sq. Cage | Immediate |
| 1572 | 75 | 440/220 | 900 | 3 | 60 | Crocker-Wh. Sq. Cage | Immediate |
| 1573 | 75 | 440/220 | 900 | 3 | 60 | Crocker-Wh. Sq. Cage | Immediate |
| 1513 | 75 | 440/220 | 900 | 3 | 60 | Gen. Elec., Sq. Cage | Immediate |
| 1515 | 75 | 440/220 | 720 | 3 | 60 | Gen. Elec. Sq. Cage | Immediate |
| 1782 | 75 | 230 | 700 | D.C. | D.C. | Gen. Elec. RC Interpole | 1 week |
| 1710A | 60 | 115 | 500 | D.C. | D.C. | Gen. Elec. CLB | Immediate |
| 1774 | 50 | 230 | 975 | D.C. | D.C. | Westinghouse SK | Immediate |
| 1779A | 50 | 125 | 850 | D.C. | D.C. | Gen. Elec. MP | 1 week |

| Stock No. | Hp. | Volts | Speed | Phase | Cycles | Make and Type | Shipment |
|---|---|---|---|---|---|---|---|
| 1680 | 50 | 220/440 | 900 | 3 | 60 | Allis-Chal. Sq. Cage | Immediate |
| 1654 | 50 | 2200 | 900 | 3 | 60 | Crocker-Wh. Sq. Cage | Immediate |
| 1402 | 50 | 440/220 | 720 | 3 | 60 | Allis-Chal. Sq. Cage | Immediate |
| 1403 | 50 | 440/220 | 720 | 3 | 60 | Allis-Chal. Sq. Cage | Immediate |
| 1404 | 50 | 440/220 | 720 | 3 | 60 | Allis-Chal. Sq. Cage | Immediate |
| 1572A | 50 | 220/440 | 600 | 3 | 40 | Crocker-Wh. Sq. Cage | Immediate |
| 1757A | 25 | 220/440 | 1800 | 3 | 60 | Gen. Elec. Sq. Cage | Immediate |
| 1720A | 25 | 230 | 725 | D.C. | D.C. | Gen. Elec. CLB | Immediate |
| 1761A | 20 | 220/440 | 1800 | 3 | 60 | Gen. Elec. Sq. Cage | 1 week |
| 1755 | 20 | 220/440 | 1200 | 3 | 40 | Gen. Elec. Sq. Cage | 2 weeks |
| 1756 | 20 | 220/440 | 1200 | 3 | 40 | Gen. Elec. Sq. Cage | 2 weeks |
| 1757 | 20 | 220/440 | 1200 | 3 | 40 | Gen. Elec. Sq. Cage | 2 weeks |
| 1558 | 20 | 230 | 675 | D.C. | D.C. | Western Electric | Immediate |
| 744 | 15 | 220 | 1800 | 2 | 60 | General Elec. Sq. Cage | Immediate |
| 1761 | 15 | 220/440 | 1200 | 3 | 40 | Gen. Elec. Sq. Cage | 2 weeks |
| 1762 | 15 | 220/440 | 1200 | 3 | 40 | Gen. Elec. Sq. Cage | 2 weeks |
| 1763 | 15 | 220/440 | 1200 | 3 | 40 | Gen. Elec. Sq. Cage | 2 weeks |
| 1772 | 15 | 220 | 1200 | 2 | 60 | Westinghse Sq. Cage | Immediate |
| 715 | 10 | 220 | 900 | 2 | 60 | Gen. Elec. Sq. Cage | 1 week |
| 715A | 10 | 220 | 900 | 3 | 60 | Gen. Elec. Sq. Cage | 1 week |
| 1427 | 10 | 440/220 | 1800 | 3 | 60 | Allis-Chal. Sq. Cage | Immediate |
| 1750 | 10 | 220/440 | 1200 | 2 | 60 | Westinghse. Slip Ring | Immediate |
| 1751 | 10 | 220/440 | 1200 | 2 | 60 | Westghse. Slip Ring | Immediate |
| 1438 | 10 | 230 | 1000 | D.C. | D.C. | Fort Wayne | Immediate |
| 1783 | 10 | 220 | 900 | 2 | 60 | Gen. Elec. Sq. Cage | 1 week |
| 1658 | 7½ | 220/440 | 1800 | 3 | 60 | Crocker-Wh. Sq. Cage | 1 week |
| 1766 | 7½ | 220/440 | 1200 | 3 | 40 | Gen. Elec. Sq. Cage | 2 weeks |
| 1767 | 7½ | 220/440 | 1200 | 3 | 40 | Gen. Elec. Sq. Cage | 2 weeks |
| 1493 | 7½ | 230 | 950 | D.C. | D.C. | Westinghse. | Immediate |
| 729 | 7½ | 220/440 | 1800 | 2 | 60 | Gen. Elec. Sq. Cage | Immediate |
| 1661 | 5 | 220 | 1200 | 2 | 60 | Gen. Elec. Sq. Cage | Immediate |

## BELTED A.C. GENERATORS

**1313**—One 100 kw., 2300 volt, 900 r.p.m., 8 pole, 3 phase, 60 cycle, General Electric, type AT Generator, with field rheostat, pulley, slide rail base and exciter ..... Immediate

## BELTED D.C. GENERATORS

**1708A**—One 100 kw., 250/275 volt, 860 r.p.m., direct current Westinghouse type S Generator with field rheostat, base and pulley. ..... Immediate

**1722**—One 85 kw., 125 volt, 720 r.p.m., direct current Westinghouse compound wound Generator with pulley, base and field rheostat. ..... Immediate

**1676**—One 75 kw. 500 volt, 750 r.p.m., direct-current compound-wound Westinghouse Generator, complete with field rheostat, pulley and base. ..... Immediate

**1773**—One 75 kw., 125 volt, 700 r.p.m., direct current, compound wound Crocker-Wheeler Generator, complete with field rheostat, pulley and base. ..... Immediate

**1710**—One 55 kw., 125 volt, 625 r.p.m., direct current, compound-wound General Electric Generator, type CLB, complete with field rheostat, pulley and base. ..... Immediate

**1774A**—One 50 kw., 250 volt, 1100 r.p.m., direct current, compound wound Westinghouse Generator, complete with field rheostat, pulley and base. ..... Immediate

**1779**—One 45 kw., 125 volt, 975 r.p.m., direct current General Electric type MP compound wound Generator, with field rheostat, base and pulley. ..... Immediate

## TRANSFORMERS

**1653**—Three 25 kw., 25 or 60 cycle, single phase, 11000/440 volt Crocker-Wheeler OISC Transformers. Immediate

## 90 WEST STREET, NEW YORK

TELEPHONE, RECTOR 5163-4

# STANDARD ELECTRIC & ELEV. CO. INC. BALTIMORE

## Electrical Equipment — Electrical Machinery

## A COMPLETE TURBINE PLANT RAEDY TO SHIP

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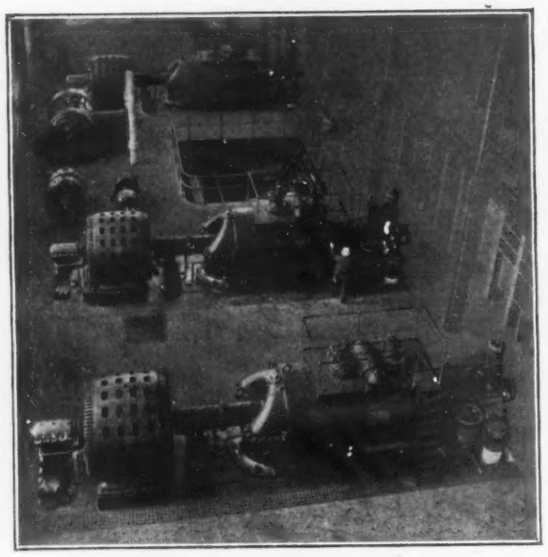


### A. C. TURBINE GENERATOR SETS

3—**2000-kva., 3-phase, 60-cycle, 6600/4000-volt, 1200-r.p.m. Westinghouse-Parsons Horizontal Turbines and Generators, complete with switchboards, exciters and Alberger 8000-sq. ft. surface condenser, with auxiliary pumps. Stirling Boilers are also available Complete plant equipment can be shipped immediately.**

### FREQUENCY CHANGERS

2—**400-kva. G.E. Frequency Changer Sets, 3-phase, 60-cycle, 13200-volt to 3-phase, 25-cycle, 6600-volt. Equipment complete and in perfect condition. Available for immediate delivery.**

# MOTORS

### 3-PH., 60-CY., 220-VOLT AND 440-VOLT MOTORS

| No. | Hp. | Make | Type | R.p.m. | Avail. |
|---|---|---|---|---|---|
| 1 | 1 | G. E. | KT | 600-1800 | Used Stock |
| 2 | 2 | W. E. | KT | 1200 | New Stock |
| 1 | 2 | Wh. | CSA | 1800 | New Works |
| 3 | 2 | Howell | S.C. | 1800 | New Stock |
| 1 | 3 | Triumph | B-6 | 1800 - U | Stock |
| 1 | 3 | Howell | S.C. | 1800 | New Stock |
| 4 | 3 | A.-C. | A.N. | 1800 | New Stock |
| 1 | 5 | G. E. | K.T. | 1800 | Used Stock |
| 1 | 7½ | Howell | S.C. | 1200 | Used Stock |
| 1 | 7½ | Howell | S.C. | 1200 | New Stock |
| 2 | 7½ | W. E. | K.T. | 1800 | New Stock |
| 3 | 7½ | Wh. | C.S. | 1800 | New Stock |
| 1 | 7½ | Wh. | C. S. | 1200 | New Stock |
| 1 | 7½ | Wh. | H.F. | 1200 | Used Stock |
| 1 | 10 | A.C. | A.N. | 720 | New Stock |
| 1 | 10 | G. E. | K.T. | 1200 | Used Stock |
| 1 | 15 | W. E. | K.T. | 1200 | New Stock |
| 1 | 20 | W. E. | K.T. | 1200 | New Stock |
| 1 | 20 | Wh. | C.W. | 1200 | New Stock |
| 1 | 20 | Wh. | H.F. | 000 | Used Stock |
| 1 | 20 | G. E. | M. | 600 | Used Stock |
| 3 | 20 | F.-M. | KBV | 1200 | Used Stock |
| 6 | 20 | F.-M. | KBV | 1200 | New Stock |
| 4 | 20 | A. C. | ANY | 1200 | New Stock |
| 2 | 20 | A.-C. | ANY | 900 | New Stock |
| 1 | 20 | W. E. | KT | 1200 | New Stock |
| 1 | 25 | Wh. | C.S. | 900 | New Stock |
| 1 | 25 | W. E. | M. | 514 | New Stock |
| 1 | 25 | Wh. | C.S. | 1200 | New 1/15 |
| 5 | 40 | W. E. | K.T. | 900 | New 1/15 |
| 2 | 50 | A.-C. | AN | 720 | New Stock |
| 2 | 75 | Wh. | C.W. | 900 | New 1/15 |
| 2 | 75 | A.-C. | A.N. | 900 | New Stock |
| 1 | 100 | Wh. | C.S. | 900 | New Stock |
| 2 | 100 | Wh. | C.W. | 900 | New Stock |
| 2 | 100 | Wh. | C.W. | 720 | New Stock |
| 1 | 100 | Wh. | C.W. | 600 | New 1/15 |
| 1 | 150 | Wh. | H.F. | 600 | Used Stock |
| 1 | 150 | Wh. | CCL 3 Brg. | 514 | Used Stock |
| 2 | 150 | Wh. | C.W. | 600 | New Stock |
| 2 | 150 | Wh. | C.W. | 900 | New 1/15 |
| 3 | 150 | Wh. | C.W. | 720 | New 1/10 |
| 2 | 200 | Wh. | C.W. | 720 | New Stock |
| 1 | 200 | Wh. | C.W. | 600 | New 1/15 |

### 3-PH., 60-CY., 550-VOLT MOTORS

| No. | Hp. | Make | Type | R.p.m. | Avail. |
|---|---|---|---|---|---|
| 6 | 15 | Wh. | C.S. | 1800 | New Stock |
| 2 | 75 | Wh. | C.W. | 900 | New 12/20 |
| 2 | 100 | Wh. | C.W. | 900 | New 12/25 |
| 1 | 150 | Wh. | H.F. | 600 | New Stock |
| 2 | 200 | Wh. | C.W. | 600 | New Stock |

### 3-PH., 60-CY., 2200-VOLT MOTORS

| No. | Hp. | Make | Type | R.p.m. | Avail. |
|---|---|---|---|---|---|
| 1 | 75 | A.-C. | ANY | 720 | New Stock |
| 2 | 75 | Wh. | C.W. | 900 | N Sh. |
| 1 | 75 | G. E. | M. | 514 | Used 1/15 |
| 1 | 100 | Wh. | C.W. | 900 | New 1/15 |
| 1 | 150 | W. E. | M. | 600 | New Stock |
| 2 | 150 | Wh. | C.W. | 600 | New Stock |
| 1 | 150 | Wh. | C.W. | 720 | New 1/15 |
| 1 | 150 | Wh. | H.F. | 600 | Used Stock |
| 2 | 200 | Wh. | C.W. | 600 | New Stock |

### SINGLE PHASE 25-CY. MOTORS

| No. | H.P. | Make | Type | R.P.M. | Avail. |
|---|---|---|---|---|---|
| 1 | 3 | Century | 110 V. | 1500 | Used St. |
| 1 | 4 | G.E. | I.S. 220 V. | 750 | U St. |

### 3-PH., 25-CY., 550-VOLT MOTORS

| No. | Hp. | Make | Type | R.p.m. | Avail. |
|---|---|---|---|---|---|
| 1 | 30 | A.C. | A.N. | 750 | Used Stock |

### 3-PH., 25-CY., 220- AND 440-VOLT

| No. | Hp. | Make | Type | R.p.m. | Avail. |
|---|---|---|---|---|---|
| 1 | 2 | Wh. | C.S. | 1500 | New Stock |
| 4 | 2 | A.-C. | A.N. | 750 | New Works |
| 1 | 3 | Wh. | C.S. | 750 | New 1/15 |
| 1 | 5 | W. E. | K.T. | 750 | New Stock |
| 3 | 5 | A.-C. | A.N. | 750 | New Stock |
| 2 | 7½ | Wh. | C.S. | 750 | New Stock |
| 1 | 7½ | A.-C. | A.N. | 750 | New Stock |
| 7 | 10 | A.-C. | A.N. | 750 | New Stock |
| 1 | 15 | W. E. | K.T. | 750 | New Stock |
| 2 | 15 | A.C. | A.N. | 1500 | New Stock |
| 2 | 15 | A.-C. | A.N. | 750 | New Stock |
| 2 | 20 | W. E. | K.T. | 750 | New Stock |
| 3 | 30 | W. E. | K.T. | 750 | New 1/15 |
| 3 | 30 | A.-C. | A.N. | 750 | New Stock |
| 4 | 40 | W. E. | K.T. | 750 | New 1/15 |
| 3 | 40 | A.-C. | A.N. | 750 | New Stock |
| 6 | 50 | W. E. | K.T. | 750 | New 1/15 |
| 3 | 50 | A.-C. | A.N. | 750 | New 1/15 |
| 3 | 75 | Wh. | C.S. | 750 | New 1/15 |
| 1 | 150 | A.-C. | ANY | 500 | New Stock |
| 1 | 150 | W. E. | K.T. | 500 | New Stock |
| 1 | 150 | W. E. | K.T. | 750 | New Stock |
| 2 | 150 | W. E. | M. | 750 | New 1/15/19 |
| 2 | 150 | W. E. | M. | 500 | New 1/15 |
| 1 | 200 | W. E. M-3 Brg. | | 500 | New 1/15 |

### 2-PH., 60-CY., 220-VOLT MOTORS

| No. | Hp. | Make | Type | R.P.M. | Avail. |
|---|---|---|---|---|---|
| 1 | 1 | W. | C.S.A. | 1725 | New B Stock |
| 1 | 2 | G. E. | K.Q. | 1200 | Used B Stock |
| 1 | 10 | W. | H.F. | 1200 | Used Stock |
| 1 | 150 | W. | C.C.L. 3 brg. | 514 | Used Stock |

### SINGLE-PHASE, 60-CY., MOTORS

| No. | H.P. | Make | Type | Volts | R.p.m. | Avail. |
|---|---|---|---|---|---|---|
| 1 | ¼ | Century | B.A. | - | | U Stock |
| 1 | ¼ | Wag. | B.A. | 110-220 | 1750 | U Stck |
| 1 | ½ | Wag. | | 104 | 1750 | U Stck |
| 1 | 2 | Wag. | | 220 | 1200 | U Stck |
| 1 | 5 | Wag. | Elev. | 220 | 900 | U Stck |
| 1 | 5 | Wag. | | 110-220 | 900 | U Stck |
| 1 | 5 | Century | | 110-220 | 1800 | N Stck |

### 110-VOLT, D.C., MOTORS

| No. | H.P. | Make | Type | R.P.M. | Avail. |
|---|---|---|---|---|---|
| 22 | 1/16 | R & M | Sh. | 900 | Used Stock |
| 1 | ¼ | W. | R | 1800 | Used Stock |
| 1 | 1¼ | Diehl | Sh. | 1180 | Used Stock |
| 1 | 1½ | Diehl | | 2000 | Used Stock |
| 1 | 15 | R & M | Cpd. | 1050 | Used Stock |
| 1 | 25 | W. | S. | 850 | Used Stock |
| 1 | 40 | W | M | 950 | Used Stock |
| 1 | 60 | W. | S.A. | 1000 | Used Stock |

### 220-VOLT, D.C., MOTORS

| No. | Hp. | Make | Type | R.P.M. | Avail. |
|---|---|---|---|---|---|
| 1 | 3 | G.I. | C.A. | 1650 | Used Stock |
| 1 | 4 | W. E. | D.F. | 1700 | Used Stock |
| 1 | 7½ | G. E. | Cpd. | 450/900 | Used Stock |
| 1 | 7½ | G. E. | C.Q. | 1525 | Used Stock |
| 1 | 10 | W. | M. | 1250 | Used Stock |
| 1 | 20 | Ft. Wayne Elev. | | 820 | Used Stock |
| 1 | 50 | W. | S. | 950 | Used Stock |

### A.C. BELTED GENERATOR

1—75-kw., 3-phase, 60-cycle, 440-volt, 720-r.p.m., used Warren Inductor type Rev. Fld. Generator, complete with rheostat, exciter, pulley and rails. In our stock.

### 110-VOLT D.C. GENERATORS

| No. | Kw. | Make | Type | R.P.M. | Avail. |
|---|---|---|---|---|---|
| 1 | 1.80 | F. M. | T.R. | 2350 | Used Stock |
| 1 | 2½ | Cr. Wh. | Cpd. | 1350 | Used Stock |
| 1 | 2½ | Rocbond | R.E. | 1200 | Used Stock |
| 1 | 10 | W. | S. | 1325 | Used Stock |
| 1 | 12 | Ohio | L. | 1670 | Used Stock |
| 1 | 18¼ | W. | S. | 950 | Used Stock |

### CHAIN DRIVES

**Link Belt Silent Chain Drive**

1—Flanged Steel Pinion, 4.987-in. diam., 25 teeth, ¾-in. pitch, 1 7/16-in. bore, ¼ x ⅛-in. K. S. tapered to ⅛-in.

1—Flanged C. I. Wheel, 11.942-in. diam., 60 tee th, ¾-in. pitch, 1 7/16-in. bore, ¼ x ⅛-in K. S., tapered to ⅛ in., CL to CL of drive, 16 in.

This Chain Drive is complete and has never been used. It is in our stock due to change in the plans of the job for which it was ordered.

### D.C. TURBINE GENERATOR SETS, 125-VOLTS

4—**10-Kw., Westinghouse Marine Type, 80-lb. steam pressure, available 12/30.**

**These turbine sets are complete and self-contained.**

**They are built according to specifications laid down by the Emergency Fleet Corporation.**

**They are also suitable for portable industrial purposes, such as the operation of lifting magnets and locomotive cranes.**

### PINION AND GEAR

1—Spur Gear 1¼ D.P., 2.0944-in. C.P. 6-in. face, 56 teeth, 37-33. in. P.D., 4/-in. bore, 1¼-in. x ¼-in. keyway, complete with Shaft and Bearing for bolting to pedestal foundation.

1—Pinion 1¼ D.P., 2. 944-in. C.P., 6-in. face, 23 teeth. 15.33-in. P.D., 4¼-in. bore, 1¼-in. x ¼-in. keyway. Gear ratio 2.4 to 1. 125 h0. at 514 r.p.m.

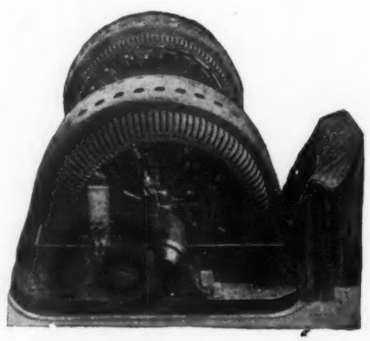
### TRANSFORMERS

3—100 Kw., Type "H," used G. E. Transformers, single phase, 25 cycle, 13,200 volts Primary, 110-220 Secondary. Outdoor type.

2—100 Kva., single-phase, 60-cycle, 13,200-v., Primary, 220-440-v. Secondary. Westinghouse Transformers Used approximately 6 weeks. Practically new.

### AIR RECEIVERS (In Our Stock)

1—30 x 72-in. Air Receiver, for 100-lb pressure.



### FREQUENCY CHANGER SET

**25-60 Cycles 4000 Kva. capacity complete and available for early delivery.**

*Meeting the Emergency Is Standard Practice*

# ARCHER & BALDWIN, Inc.

***Machinery in Stock for Immediate Shipment***

### 250 Volt Direct Current, Direct Connected Units

1—150-kw. Thompson Ryan compound wound Generator, 200-r.p.m., direct connected to 15 and 25 x 18 horizontal tandem compound McEwen automatic engine
1—125-kw. Westinghouse, 8-pole, compound wound Generator, 280 r.p.m., direct connected to 14 and 24 x 14 Westinghouse compound engine
1—50 kw. Westinghouse 375-r.p.m. generator, direct connected to 13 x 12 Skinner engine
1—37½-kw. Westinghouse, 320-r.p.m., compound wound Generator, direct connected to 10 and 18 x 10 Westinghouse engine.

### 125 Volt Direct Current, Direct Connected Units

1—62½-kw. Westinghouse, 329-r.p.m. Generator, direct connected to 10 and 18 x 10 Westinghouse engine
1—60-kw. G. E. 118/120-v., 6-pole, compound wound Generator, 280-r.p.m., direct connected to 12½ x 14 Watertown horizontal right-hand engine
1—50-kw. Western Electric, 125-v., 6-pole, compound Generator, direct connected to 10 x 11 Russell engine
2—30-kw. Sturtevant, 125-v., 6-pole Generator, 325-r.p.m., direct connected to 9 x 9 Sturtevant engine
1—30-kw. Westinghouse, 110-v., 6-pole Generator, 325-r.p.m., direct connected to 10 x 12 Harrisburg horizontal engine
1—30-kw. Western Electric, 115/125-v., 6-pole, compound, wound Generator, Erie Ball center crank engine
1—20-kw. G. E. 125-v., 6-pole Generator, 360-r.p.m., direct connected to Marine type automatic engine
1—20-kw. Diehl Generator, 2500-r.p.m., direct connected to Terry Turbine, 100-lb. pressure
1—8-kw. Westinghouse 118-v., 575 r.p.m. generator direct connected to American Blower engine

### 550 Volt Generators

1—250-kw. Westinghouse, 450-r.p.m.
1—150-kw. Westinghouse, 550-r.p.m.

### Gas or Gasoline Unit

1—5-kw., G. E. 3-wire, 125/250-v., Generator, 750-r.p.m., direct connected to G. E., 4-cylinder gas engine, all complete

### 125 Volt D. C. Generators

1—100-kw. General Electric, type MP, 650-r.p.m.
2—75-kw. General Electric, CL, 550-r.p.m.
1—50-kw. General Electric, CL, 600-r.p.m.
1—45-kw. C. & C., type SL, 920-r.p.m.
1—45-kw. General Electric, MP, 975-r.p.m.
1—42½-kw. Sprague, 650-r.p.m.
1—42½-kw. Bullock, 600-r.p.m.
1—40-kw. Wood, 1000-r.p.m.
1—40-kw. Crocker-Wheeler, 1050-r.p.m.
1—30-kw. Eddy, 900-r.p.m.
1—25-kw. Crocker-Wheeler, 875-r.p.m.
1—25-kw. Hawthorne, 900-r.p.m.
1—22½-kw. Westinghouse, 975-r.p.m.
1—18-kw. Bullock, 1400-r.p.m.

### 125 Volt D.C. Motors

1—90-hp. General Electric, 500-r.p.m.
1—60-hp. Holtzer-Cabot, 615-r.p.m.
1—50-hp. Sprague, 540-r.p.m.
1—30-hp. Fisher, 600-r.p.m.
1—25-hp. General Electric, 580-r.p.m.
1—25-hp. General Electric, 1100-r.p.m.
1—25-hp. Peerless, 710-r.p.m.
1—25-hp. Crocker-Wheeler, 1025-r.p.m.
1—20-hp. Western Electric, 900-r.p.m.
1—20-hp. General Electric, 1600-r.p.m.
1—20-hp. General Electric, 925-r.p.m.
5—20-hp. General Electric, 1040-r.p.m.
1—15-hp. General Electric, 1000-r.p.m.
2—15-hp. General Electric, 690-r.p.m.
4—10-hp. General Electric, 115-v., 1250-r.p.m.
1—10-hp. General Electric, 115-v., 1100-r.p.m.
1—10-hp. Crocker-Wheeler, 115-v., 1000-r.p.m.
1—10-hp. Crocker-Wheeler, 115-v., 825-r.p.m.
1—10-hp. General Electric, 115-v., 650-r.p.m.
**Also stock of Motors in smaller sizes.**

### 550 Volt Turbo Unit

1—15-kw. Diehl, 2500-r.p.m. Generator and 27-hp. 500-v. Terry Turbine, 75-lb. steam pressure

### Boilers

4—400-hp. Lyons Boilers, 150-lb. pressure
2—300-hp. Heine Boilers, 175-lb. pressure

### 250 Volt D.C. Motors

1—60-hp. Westinghouse, 1150-r.p.m.
2—20-hp. Northern, 950-r.p.m.
1—15-hp. General Electric, 1100-r.p.m.
1—10-hp. General Electric, 1375-r.p.m.
1— 5-hp. General Electric, 1650-r.p.m.

### 500 Volt Motors

1—60-hp. General Electric, 900-r.p.m.
1—50-hp. General Electric, 900-r.p.m.
1—40-hp. Westinghouse, 660-r.p.m.
1—40-hp. General Electric, 975-r.p.m.
1—15-hp. General Electric, 1200-r.p.m.
2—5-hp. General Electric, 1350-r.p.m.
1—5-hp. Crocker-Wheeler, 1700-r.p.m.

### Rotary Converters

1—300-kw. Westinghouse, 3-ph., 60-cy., 370-v., A.C., 575-v., D.C., 600-r.p.m.
1—150-kw. Westinghouse, 2-or 3-ph., 60-cy., 185-v., A.C., 250-v., D.C., 720-r.p.m., with direct connected starting motor on end of shaft.
NOTE—Above rotaries can be furnished with transformers suitable for any high voltage.

### Pumps

1—14-in. Worthington Volute type Centrifugal Pump, direct connected to 11 x 12 Blake vertical engine
2—8-in. Worthington Volute Centrifugal Vertical Pumps, 10 in. suction, 8 in. discharge, direct connected to and operated by two 15-hp. Westinghouse, 3-ph. 60 cy., 220-v., 485-r.p.m. vertical motors

### Condensers

2—2000-sq. ft. Wheeler Surface Condensers
1—9 x 12 x 10 in. Worthington Jet
1—12 x 16 x 18 -in. Blake Jet Condenser

### Engines

1—22 x 42-in. Allis-Chalmers, 80-r.p.m.
1—14 x 20-in. Russell, 200-r.p.m.
1—13 x 12-in. Armington & Sims, 250-r.p.m.

**114-118 Liberty Street, New York City**

**TELEPHONE 4337-4338 RECTOR**

# BARGAINS!—*For Immediate Shipment*

**ALTERNATING CURRENT MOTORS—ALL NEW**
**3-Phase, 60-Cycle**

| No. | Hp. | R.p.m. | Volts | Type | Make | Price ea. |
|---|---|---|---|---|---|---|
| 7 | 3 | 1800 | 220 or 440 | AN | Allis-Chal. | $91 |
| 1 | 3 | 1200 | 220 or 440 | AN | Allis-Chal. | 114 |
| 11 | 5 | 1800 | 220 or 440 | AN | Allis-Chal. | 110 |
| 10 | 5 | 1200 | 220 or 440 | AN | Allis-Chal. | 140 |
| 4 | 7½ | 1800 | 220 or 440 | AN | Allis-Chal. | 223 |
| 3 | 7½ | 1200 | 220 or 440 | AN | Allis-Chal. | 254 |
| 3 | 7½ | 900 | 220 or 440 | AN | Allis-Chal. | 309 |
| 1 | 10 | 800 | 220 or 440 | CS | Westghse. | 258 |
| 11 | 10 | 1800 | 220 or 440 | AN | Allis-Chal. | 258 |
| 13 | 10 | 1200 | 220 or 440 | AN | Allis-Chal. | 314 |
| 3 | 10 | 900 | 220 or 440 | AN | Allis-Chal. | 375 |
| 1 | 15 | 1800 | 220 or 440 | AN | Allis-Chal. | 284 |
| 4 | 15 | 1200 | 220 or 440 | AN | Allis-Chal. | 384 |
| 6 | 15 | 900 | 220 or 440 | AN | Allis-Chal. | 410 |
| 4 | 20 | 1200 | 220 or 440 | AN | Allis-Chal. | 412 |
| 3 | 20 | 900 | 220 or 440 | AN | Allis-Chal. | 461 |
| 1 | 25 | 1800 | 220 or 440 | AN | Allis-Chal. | 396 |
| 3 | 25 | 1200 | 220 or 440 | AN | Allis-Chal. | 467 |
| 9 | 30 | 1200 | 220 or 440 | AN | Allis-Chal. | 517 |
| 6 | 30 | 900 | 220 or 440 | AN | Allis-Chal. | 598 |
| 3 | 40 | 1200 | 220 or 440 | AN | Allis-Chal. | 598 |
| 5 | 40 | 900 | 220 or 440 | AN | Allis-Chal. | 670 |
| 2 | 50 | 1200 | 220 or 440 | AN | Allis-Chal. | 667 |
| 6 | 50 | 900 | 220 or 440 | AN | Allis-Chal. | 744 |
| 1 | 75 | 900 | 220 or 440 | AN | Allis-Chal. | 959 |
| 1 | 100 | 900 | 220 or 440 | AN | Allis-Chal. | 1200 |
| 1 | 150 | 720 | 220 or 440 | AN | Allis-Chal. | 1667 |
| 1 | 200 | 720 | 220 or 440 | AN | Allis-Chal. | 1980 |

**SLIP RING, ALTERNATING CURRENT MOTORS**
**3-Phase, 60-Cycle**

| | | | | | | |
|---|---|---|---|---|---|---|
| 1 | 100 | 900 | 220 or 440 | ANY | Allis-Chal. | 1545 |
| 2 | 150 | 900 | 220 or 440 | ANY | Allis-Chal. | 1915 |
| 1 | 200 | 720 | 220 or 440 | ANY | Allis-Chal. | 2536 |

**DIRECT CURRENT MOTORS—ALL REBUILT**
**220 to 250 Volts**

Items listed below include rails, pulleys and starters. Standard size pulleys will be furnished. Extra size pulleys will be furnished if required at a small additional cost.

| No. | Hp. | R.p.m. | Wdg. | Type | Make | Price |
|---|---|---|---|---|---|---|
| 1 | ¼ | 975 | sh | ..... | Westinghouse | $33 |
| 2 | 1 | 750 | series | D | Mech. App. | 65 |
| 1 | 3 | 1100 | sh | Form A | G. E. | 115 |

| No. | Hp. | R.p.m. | Wdg. | Type | Make | Price |
|---|---|---|---|---|---|---|
| 1 | 5 | 1650 | sh | C | G. E. | $140 |
| 3 | 7½ | 850 | sh | A | Gibbs | 250 |
| 1 | 7½ | 1100 | sh | Class 4 | G. E. | 225 |
| 1 | 10 | 750 | sh | MP | Burke | 260 |
| 3 | 10 | 750 | sh | MP | Northwestern | 270 |
| 1 | 15 | 925 | sh | CVC | G. E. | 370 |
| 1 | 15 | 1750 | cp | CVC | G. E. | 350 |
| 1 | 15 | 600 | sh | MP | Triumph | 300 |
| 1 | 15 | 725 | cp | MP | Northern | 385 |
| 1 | 17½ | 600 | sh | A-14 | Gibbs | 325 |
| 1 | 17½ | 585 | sh | A-14 | Gibbs | 325 |
| 1 | 20 | 650 | sh | MP | Burke | 425 |
| 1 | 20 | 975 | sh | MP | Fairbanks-Morse | 415 |
| 1 | 20 | 900 | sh | MP | Hobart | 390 |
| 1 | 20 | 800 | sh | MP | Imperial | 390 |
| 1 | 20 | 650 | sh | MP | Milwaukee | 400 |
| 1 | 20 | 975 | sh | S | Westinghouse | 425 |
| 1 | 20 | 600 | sh | MP | Western Elec. | 425 |
| 1 | 20 | 750 | sh | MP | Northern | 400 |
| 1 | 25 | 650 | sh | MP | National Brake | 425 |
| 1 | 25 | 775 | sh | MP | Western Elec. | 500 |
| 1 | 25 | 675 | sh | CL | G. E. | 525 |
| 2 | 25 | 800 | cp | MP | Northern | 475 |
| 1 | 25 | 700 | sh | MP | Allis-Chalmers | 525 |
| 1 | 25 | 575 | sh | MP | Northern | 575 |
| 1 | 30 | 600 | sh | MP | Burke | 600 |
| 1 | 30 | 250-800 | cp | MP | G. E. | 585 |
| 1 | 35 | 610 | sh | GL-B | G. E. | 600 |
| 1 | 40 | 975 | cp | GL-B | G. E. | 700 |
| 1 | 40 | 675 | sh | MP | Northwestern | 715 |
| 1 | 40 | 850 | cp | S | Westinghouse | 725 |
| 1 | 40 | 550 | sh | M | Westinghouse | 780 |
| 1 | 50 | 850 | sh | S | Westinghouse | 825 |
| 1 | 50 | 625 | sh | MP | Northern | 790 |
| 1 | 50 | 625 | sh | A-40 | Milwaukee | 770 |
| 1 | 50 | 950 | cp | CCD | Crocker-Wheeler | 850 |
| 1 | 55 | 900 | cp | GL-B | G. E. | 850 |
| 1 | 80 | 630 | cp | CQ | G. E. | 950 |
| 1 | 120 | 450 | cp | MP | G. E. | 1550 |
| 1 | 130 | 550 | cp | S | Westinghouse | 1400 |
| 1 | 134 | 650 | cp | MP | Morgan-Gardner | 1475 |
| 1 | 165 | 650 | cp | M | Westinghouse | 1600 |
| 1 | 300 | 340 | cp | CCD | Crocker-Wheeler | 3000 |
| 1 | 400 | 200 | cp | M | Westinghouse | 3500 |

**Office and Factory PITTSBURGH PA.**

## DUQUESNE ELECTRIC & MANUFACTURING CO.

***New and Rebuilt Electrical Equipment***

**Write, Wire or Telephone our Nearest Office**

**Western Office & Warehouse 230 So. La Salle St. CHICAGO**

# 220 VOLT DIRECT CURRENT MOTORS

All motors are furnished with rails or bases pulleys and starting boxes, except motors under 1 H.P., which are furnished without rails, and under ¾ H.P. which are furnished without rails or starters. All motors shunt wound unless otherwise noted.

| Qu. | H.P. | Make | Type | Speed |
|---|---|---|---|---|
| 1 | ¼ | General Electric | CA | 800 |
| 1 | ¼ | General Electric | CQ | 1000 |
| 1 | ¼ | Robbins & Myers | | 1000 |
| 1 | ¼ | Westinghouse | R | 450 |
| 2 | ¾ | General Electric | B | 1050 |
| 1 | ¼ | General Electric—series—special bearings | CQ | 1600 |
| 1 | ¼ | General Electric | CA | 1650 |
| 1 | ¼ | General Electric | CA | 650 |
| 1 | ¼ | Sprague | RT | 1500 |
| 4 | ¼ | Westinghouse | R | 1500/2300 |
| 1 | ¼ | Holtzer-Cabot | | 1150 |
| 1 | ½ | General Electric | CQ | 1475 |
| 3 | ½ | General Electric—New | BA | 2500 |
| 1 | 1 | General Electric—compound—field rheostat for speed regulation | BC | 900/1200 |
| 1 | 1 | General Electric—back geared | CQ | 1275 |
| 1 | 1 | Browning—series—no starter | | 1165 |
| 1 | 1½ | Westinghouse | S | 900 |
| 1 | 2 | Triumph | 16E | 1750 |
| 1 | 2 | Westinghouse—compound | SK | 1200 |
| 1 | 2 | Robbins & Myers | | 1100 |
| 1 | 2 | Quaker City | | 1550 |
| 1 | 2 | General Electric | CA | 1800 |
| 1 | 2 | Connecticut—direct connected to a Pressure Blower | | |
| 1 | 3 | General Electric | RC | 1700 |
| 5 | 3 | General Electric | CVC | 1200 |
| 1 | 3 | General Electric | CVC | 1650 |
| 2 | 3 | General Electric | CQ | 1650 |
| 1 | 3 | Western Electric | RC | 1750 |
| 1 | 3 | Westinghouse—compound | SK | 1100 |
| 2 | 3 | General Electric | CVC | 1100 |
| 2 | 3 | General Electric | CQ | 1060 |
| 1 | 3 | National | | 1100 |
| 1 | 3 | Diehl | G | 700 |
| 2 | 3 | Sprague | RT | 1200 |
| 1 | 3 | Otis Elevator Motor—series wound | | 750 |
| 1 | 3 | Fort Wayne | E | 1750 |
| 1 | 3 | Crocker-Wheeler | L | 1437 |
| 2 | 3½ | Diehl | G | 1100 |
| 2 | 3½ | Westinghouse | SK | 830/1200 |
| 1 | 3½ | Bullock | | 900 |
| 1 | 3½ | Burke, with drum controller | | 935/1850 |
| 1 | 3½ | General Electric | CE | 750 |
| 1 | 4½ | General Electric—with compound starter | RLC | 1200/1800 |
| 1 | 4½ | Westinghouse—New—series | S | 1200 |
| 1 | 4½ | Westinghouse | 4-SA | 400/1200 |
| 1 | 5 | Quaker City | | 1200 |
| 1 | 5 | General Electric | CE | 1100 |
| 1 | 5 | General Electric | CE | 360 |
| 1 | 5 | General Electric | CE | 375 |
| 1 | 5 | General Electric | CQ | 1650 |
| 1 | 5 | Crocker Wheeler | F | 1100 |
| 1 | 6 | Westinghouse | S | 1465 |
| 1 | 7½ | General Electric—Buffing motor | CE | 2000 |
| 1 | 7½ | General Electric | CQ | 825 |
| 2 | 7½ | C. & C. | | 500 |
| 1 | 7½ | Eddy | G | 1000 |
| 2 | 10 | General Electric | CQC | 400/1600 |
| 1 | 10 | Browning | | 1260 |
| 1 | 10 | General Electric | CR | 450/1350 |
| 1 | 11 | Westinghouse—crane—series wound motor only | K | 700 |
| 3 | 15 | National | NL | 770 |
| 2 | 15 | Crocker-Wheeler | D | 750 |
| 1 | 20 | General Electric | H | 700 |
| 1 | 20 | Fort Wayne | EF | 1200/1800 |
| 1 | 20 | Burke | AM | 650 |
| 1 | 20 | General Electric | CLB | 660 |
| 1 | 20 | Crocker-Wheeler | D | 800 |
| 1 | 25 | Crocker-Wheeler | D | 750 |
| 1 | 25 | General Electric | H | 600 |
| 1 | 25 | General Electric | CL | 600 |
| 2 | 25 | Westinghouse—series | 12-A | |
| 1 | 25 | Westinghouse | 7-S | 850 |
| 1 | 30 | Commercial | | 850 |
| 1 | 30 | Crocker-Wheeler | D | 360 |
| 1 | 30 | General Electric | H | 910 |
| 1 | 35 | Crocker Wheeler | I | 600 |
| 2 | 35 | Crocker-Wheeler | D | 750 |
| 1 | 35 | Westinghouse | SK | 1150 |
| 2 | 50 | Westinghouse—with drum controllers | SK | 750/1125 |
| 1 | 50 | General Electric | H | 605 |
| 1 | 60 | General Electric—New | CO-2507 | 700 |
| 1 | 75 | General Electric—crane type GE 211 | | 350 |
| 2 | 77 | Sprague—interpole—compound | C | 180 |
| 1 | 150 | Northern | | |

**NEW ROTARY CONVERTER**

1—200-kw., 250/275 volt, 1200 r.p.m. Westinghouse, complete with switchboard panel and transformers for 2300 or 4000 volts, 3-phase, 60-cycle..

**MOTOR GENERATOR SETS**

1—100-kw., 250-volt, 850 r.p.m., to a 150-hp., 3-phase, 60-cycle, 2090-volt motor, Allis-Chalmers, 2 bearing, with starter.

1—250-kw., 550-volt, 450 r.p.m. Bullock generator, direct connected to a 370-hp., 2200-volt, 3 -phase, Bullock alternator. Above generator could be connected for 250 volts.

**250 VOLT DIRECT CONNECTED SET**

1—300-kw., 150 r.p.m. General Electric generator, direct connected to a 20 and 34 x 28 Fitchburg, 4-valve tandem compound engine.

**We Carry a Large Stock of Direct Current Motors in All Voltages. Also transformers, Single, Two and Three Phase Motors.**

***Send For Our Catalog Which Gives Full Information and Prices.***

**GEORGE SACHSENMAIER CO.,** OFFICE AND SALESROOMS: 141-43-45 N. 3rd ST., WAREHOUSE AND SHOP: 928-30-32 N. 3rd ST., **Philadelphia**

***LET US KNOW WHAT YOU HAVE FOR SALE***

# NEW ELECTRIC MOTORS IN PITTSBURGH STOCK

## HARRIS PUMP & SUPPLY COMPANY

***Pittsburgh's Big Motor House***

**320-322-223 Second Ave., 319-321 First Ave., Pittsburgh, Pa.**

## WE HAVE NO USED MOTORS

**DIRECT CURRENT**

| Quan. | Hp. | Voltage | Speed | Type | Make |
|---|---|---|---|---|---|
| 15 | 2 | 230 | 1725 | CD | Westinghouse |
| 3 | 2 | 230 | 1700 | RC | Gen. Elec. |
| 7 | 3 | 230 | 1725 | CD | Westinghouse |
| 3 | 3 | 230 | 1150 | RC | Gen. Elec. |
| 4 | 3 | 230 | 1150 | SK | Westinghouse |
| 11 | 3 | 230 | 1700 | RC | Gen. Elec. |
| 13 | 5 | 230 | 1150 | RC | Gen. Elec. |
| 2 | 5 | 230 | 850 | SK | Westinghouse |
| 16 | 5 | 230 | 1200 | SK | Westinghouse |
| 3 | 5 | 230 | 1800 | SK | Westinghouse |
| 1 | 7½ | 230 | 850 | SK | Westinghouse |
| 11 | 7½ | 230 | 1150 | RC | Gen. Elec. |
| 6 | 7½ | 230 | 1150 | SK | Westinghouse |
| 9 | 7½ | 230 | 1700 | SK | Westinghouse |
| 8 | 7½ | 230 | 1700 | RC | Gen. Elec. |
| 12 | 10 | 230 | 1150 | SK | Westinghouse |
| 10 | 10 | 230 | 1750 | SK | Westinghouse |
| 5 | 10 | 230 | 1150 | RC | Gen. Elec. |
| 1 | 10 | 230 | 1700 | RC | Gen. Elec. |
| 1 | 15 | 230 | 1150 | RC | Gen. Elec. |
| 1 | 15 | 230 | 1700 | SK | Westinghouse |
| 3 | 15 | 230 | 1700 | RC | Gen. Elec. |
| 1 | 20 | 230 | 800 | RC | Gen. Elec. |
| 1 | 30 | 230 | 1700 | ... | Reliance |

**DIRECT CURRENT—500-550 VOLTS**

| Quan. | Hp. | Voltage | Speed | Type | Make |
|---|---|---|---|---|---|
| 7 | 2 | 550 | 1850 | CD | Westinghouse |
| 2 | 3 | 550 | 1900 | CD | Westinghouse |
| 5 | 5 | 550 | 1300 | RC | Gen. Elec. |
| 1 | 5 | 550 | 1560 | ... | Peerless |
| 15 | 5 | 500 | 1200 | SK | Westinghouse |
| 3 | 7½ | 550 | 850 | SK | Westinghouse |
| 10 | 7½ | 550 | 1150 | SK | Westinghouse |
| 1 | 7½ | 550 | 1700 | SK | Westinghouse |
| 6 | 7½ | 550 | 1300 | RC | Gen. Elec. |
| 1 | 7½ | 550 | 1800 | RC | Gen. Elec. |
| 2 | 10 | 550 | 1200 | RC | Gen. Elec. |
| 1 | 10 | 550 | 1800 | RC | Gen. Elec. |
| 5 | 10 | 550 | 1150 | SK | Westinghouse |
| 7 | 10 | 550 | 1700 | SK | Westinghouse |
| 1 | 15 | 550 | 1700 | SK | Westinghouse |
| 2 | 20 | 550 | 1700 | SK | Westinghouse |
| 1 | 25 | 550 | 900 | RC | Gen. Elec. |
| 1 | 30 | 550 | 1700 | SK | Westinghouse |

**SINGLE PHASE—110-220 VOLTS**

| | | | | | |
|---|---|---|---|---|---|
| 3 | ¼ | 110-220 | 1750 | ... | Century |
| 1 | ¼ | 110-220 | 1165 | ... | Century |
| 2 | ¼ | 110-220 | 1750 | CA | Westinghouse |
| 1 | ½ | 110-220 | 1165 | ... | Century |
| 1 | 1 | 110-220 | 1750 | ... | Century |
| 1 | 1 | 110-220 | 1165 | ... | Century |
| 8 | 1½ | 110-220 | 1750 | ... | Century |
| 2 | 2 | 110-220 | 1150 | ... | Century |
| 6 | 2 | 110-220 | 1750 | .... | Century |
| 1 | 2 | 110-220 | 1750 | ... | Wagner |
| 1 | 3 | 110-220 | 1750 | ... | Wagner |
| 1 | 5 | 110-220 | 1165 | ... | Century |

**VERTICAL SINGLE PHASE**

| | | | | | |
|---|---|---|---|---|---|
| 1 | 1 | 110-220 | 1750 | ... | Century |

**ALTERNATING CURRENT**

**220-VOLT, 3-PHASE, 60-CYCLE**

| Quan. | Hp. | Voltage | Speed | Type | Make |
|---|---|---|---|---|---|
| 1 | ¼ | 220 | 1800 | KQ | Gen. Elec. |
| 1 | 1 | 220 | 1200 | KQ | Gen. Elec. |
| 4 | 1 | 220 | 1200 | KT | Gen. Elec. |
| 1 | 2 | 220 | 1200 | KQ | Gen. Elec. |
| 5 | 3 | 220 | 1200 | KT | Gen. Elec. |
| 14 | 3 | 220 | 1800 | KT | Gen. Elec. |
| 7 | 3 | 220 | 1755 | CS | Westinghouse |
| 14 | 5 | 220 | 1200 | KT | Gen. Elec. |
| 10 | 5 | 220 | 1800 | KT | Gen. Elec. |
| 2 | 5 | 220 | 1160 | BP | Wagner |
| 2 | 5 | 220 | 1720 | BP | Wagner |
| 7 | 5 | 220 | 1200 | CS | Westinghouse |
| 13 | 5 | 220 | 1800 | CS | Westinghouse |
| 2 | 7½ | 220 | 1200 | CS | Westinghouse |
| 2 | 7½ | 220 | 1150 | AS | Century |
| 4 | 7½ | 220 | 1140 | BW | Wagner |
| 1 | 7½ | 220 | 1200 | MT | Gen. Elec. |
| 1 | 7½ | 220 | 1800 | KT | Gen. Elec. |
| 1 | 10 | 220 | 900 | CS | Westinghouse |
| 1 | 10 | 220 | 1140 | BW | Wagner |
| 2 | 10 | 220 | 1150 | AS | Century |
| 2 | 10 | 220 | 1200 | CS | Westinghouse |
| 4 | 10 | 220 | 1800 | KT | Gen. Elec. |
| 6 | 10 | 220 | 1200 | KT | Gen. Elec. |
| 5 | 10 | 220 | 1800 | CS | Westinghouse |
| 2 | 15 | 220 | 1140 | BW | Wagner |
| 2 | 15 | 220 | 1200 | ... | Reliance |
| 6 | 15 | 220 | 1200 | CS | Westinghouse |
| 1 | 15 | 220 | 1160 | CW | West. Slip Ring |
| 1 | 15 | 220 | 1750 | BP | Wagner |
| 4 | 15 | 220 | 1200 | KT | Gen. Elec. |
| 1 | 15 | 220 | 900 | KT | Gen. Elec. |
| 6 | 15 | 220 | 1800 | CS | Westinghouse |
| 1 | 20 | 220 | 1155 | ... | Century |
| 1 | 20 | 220 | 1800 | ... | Burke Slip Rg. |
| 2 | 20 | 220 | 1200 | ... | Reliance |
| 4 | 20 | 220 | 1200 | KT | Gen. Elec. |
| 2 | 20 | 220 | 1200 | KBV | Fairbanks-M. |
| 1 | 20 | 220 | 900 | KT | Gen. Elec. |
| 1 | 25 | 220 | 1200 | CS | Westinghouse |
| 2 | 25 | 220 | 1800 | KT | Gen. Elec. |
| 5 | 25 | 220 | 1800 | CS | Westinghouse |

**ALTERNATING CURRENT**

**440-VOLTS, 60-CYCLE, 3-PHASE**

| Quan. | Hp. | Voltage | R.p.m. | Type | Make |
|---|---|---|---|---|---|
| 4 | 1 | 440 | 1200 | KT | Gen. Elec. |
| 3 | 2 | 440 | 1200 | KT | Gen. Elec. |
| 2 | 2 | 440 | 1200 | CS | Westinghouse |
| 1 | 3 | 440 | 1200 | KT | Gen. Elec. |
| 3 | 3 | 440 | 1800 | KT | Gen. Elec. |
| 1 | 3 | 440 | 1200 | CS | Westinghouse |
| 4 | 5 | 440 | 1200 | KT | Gen. Elec. |
| 2 | 5 | 440 | 1800 | KT | Gen. Elec. |
| 5 | 5 | 440 | 1800 | CS | Westinghouse |
| 1 | 5 | 440 | 1100 | CS | Westinghouse |
| 1 | 7½ | 440 | 850 | CS | Westinghouse |
| 5 | 7½ | 440 | 1200 | CS | Westinghouse |
| 3 | 7½ | 440 | 1200 | KT | Gen. Elec. |
| 10 | 10 | 440 | 1200 | CS | Westinghouse |
| 2 | 10 | 440 | 860 | CS | Westinghouse |
| 4 | 10 | 440 | 1800 | CS | Westinghouse |
| 1 | 15 | 440 | 1200 | ... | Reliance |
| 4 | 25 | 440 | 1200 | KT | Gen. Elec. |
| 2 | 25 | 440 | 1200 | CS | Westinghouse |
| 2 | 30 | 440 | 1800 | CS | Westinghouse |
| 1 | 30 | 404 | 1200 | KT | Gen. Elec. |

# INDEPENDENT ELECTRIC MACHINERY CO.

## CENTRAL STREET and GOODRICH PLACE, KANSAS CITY, MO.

### 25-CYCLE, 3-PHASE, 220-440 VOLT MOTORS

| No. | H.P. | Name | Speed |
|---|---|---|---|
| 1 | 1 | Richmond | 1420 |
| 1 | 1 | General Electric | 1500 |
| 3 | 2 | General Electric | 1500 |
| 1 | 2 | General Electric | 1400 |
| 1 | 2 | Ideal | 710 |
| 1 | 2 | Western Electric | 1500 |
| 1 | 3 | Ideal | 1400 |
| 1 | 3 | Robbins & Myers (New) | 1400 |
| 5 | 3 | General Electric | 1500 |
| 1 | 5 | Robbins & Myers (New) | 1400 |
| 1 | 5 | Allis-Chalmers | 715 |
| 3 | 7½ | Robbins & Myers (New) | 1400 |
| 1 | 7½ | Ideal | 1400 |
| 1 | 7½ | Burke | 750 |
| 1 | 10 | Burke | 750 |
| 2 | 15 | General Electric | 1500 |
| 1 | 15 | Ideal | 720 |
| 1 | 15 | Robbins & Myers (New) | 720 |
| 2 | 15 | Burke | 750 |

### 60-CYCLE, 3-PHASE, 220-VOLT MOTORS

| No. | H.P. | Name | Speed |
|---|---|---|---|
| 1 | ¼ | Fairbanks-Morse | 1200 |
| 1 | 1 | General Electric | Var |
| 1 | 1 | Fairbanks-Morse | 1200 |
| 1 | 1 | Robbins & Myers | 1750 |
| 3 | 2 | Robbins & Myers (New) | 1750 |
| 1 | 2 | Westinghouse | 580 |
| 4 | 3 | Robbins & Myers (New) | 1750 |
| 6 | 3 | Robbins & Myers (New) | 1150 |
| 1 | 3 | Ideal | 1750 |
| 1 | 3 | Allis-Chalmers | 1130 |
| 9 | 5 | Robbins & Myers (New) | 1750 |
| 7 | 5 | Robbins & Myers (New) | 1150 |
| 3 | 5 | Crocker-Wheeler (New) | 1750 |
| 1 | 5 | Robbins & Myers | 900 |
| 1 | 5 | Wagner (New) | 1140 |
| 1 | 5 | Western Electric | 1800 |
| 3 | 7½ | Robbins & Myers (New) | 1150 |
| 1 | 7½ | Allis-Chalmers | 1150 |
| 9 | 7½ | Robbins & Myers | 1750 |
| 1 | 7½ | Ideal | 1800 |
| 2 | 7½ | Robbins & Myers | 850 |
| 3 | 10 | Wagner (New) | 1140 |
| 4 | 10 | Robbins & Myers (New) | 1150 |
| 3 | 10 | Robbins & Myers (New) | 1750 |
| 2 | 10 | Robbins & Myers (New) | 850 |
| 1 | 10 | Wagner Vertical | 1800 |
| 5 | 15 | Robbins & Myers (New) | 1750 |
| 3 | 15 | Robbins & Myers | 1150 |
| 1 | 15 | Robbins & Myers | 850 |
| 4 | 20 | Robbins & Myers (New) | 1150 |
| 2 | 20 | Robbins & Myers (New) | 1750 |
| 2 | 25 | Robbins & Myers (New) | 1750 |
| 1 | 25 | Robbins & Myers (New) | 1150 |
| 3 | 25 | Robbins & Myers | 850 |
| 1 | 25 | Lincoln 2200 V. | 1200 |
| 3 | 30 | Robbins & Myers (New) | 1150 |
| 1 | 30 | Robbins & Myers (New) | 840 |
| 1 | 30 | Fairbanks-Morse 2200 V. | 1200 |
| 1 | 30 | West. El., Slp.rg. 2200 V. | 350 |
| 1 | 30 | Westinghouse | 900 |
| 1 | 35 | General Electric 2200 V. | 1150 |
| 1 | 40 | Allis-Ch., Sq. Cg. 2200 V. | 865 |
| 1 | 50 | Westing., Slp. rg. 2200 V. | 725 |
| 1 | 50 | Allis-Ch., Sq. Cg. 2200 V. | 865 |
| 1 | 50 | Allis-Chalmers Slip Ring | 865 |
| 1 | 50 | Allis-Ch., Slp. rg. 2200 V. | 865 |
| 2 | 100 | Allis-Chalmers 2200 V. | 865 |

### 220-VOLT D.C. MOTORS

| No. | H.P. | Name | Speed |
|---|---|---|---|
| 1 | 1 | General Electric | 1275 |
| 1 | 1 | Sturtevant | 300 |
| 2 | 1½ | Emerson (New) | 1150 |
| 1 | 2 | Peerless | 1225 |
| 1 | 7½ | General Electric | 1500 |
| 1 | 7½ | Colonial | 1400 |
| 2 | 7½ | General Electric | 815 |
| 1 | 7½ | Northern | 1650 |
| 1 | 7½ | Westinghouse | 1350 |
| 6 | 10 | Crocker-Wheeler | 825 |
| 1 | 10 | Northern | 825 |
| 1 | 10 | American Engine Co. | 1140 |
| 1 | 12½ | Robbins & Myers | 850 |
| 1 | 15 | General Electric (Crane) | 600 |
| 1 | 15 | Northern | 535 |
| 3 | 30 | General Electric (Vertical) | 1500 |
| 1 | 110 | Crocker-Wheeler | 560 |

### 110-VOLT D.C. GENERATORS

| No. | Kw. | Name | Speed |
|---|---|---|---|
| 1 | 27 | Burke | 1100 |
| 1 | 30 | W. E., 3-wire | 775 |
| 1 | 50 | G. E. | 1150 |
| 1 | 50 | Westinghouse | 850 |
| 1 | 50 | Eddy | 800 |
| 1 | 75 | W. E., engine type | 275 |

### 220-VOLT D.C. GENERATORS

| No. | Kw. | Name | Speed |
|---|---|---|---|
| 1 | 12½ | Fairbanks-Morse, 3-wire | 1450 |
| 1 | 17½ | Triumph | 1200 |
| 1 | 40 | Western Electric | 775 |
| 1 | 60 | Commercial | 700 |
| 1 | 60 | Westinghouse | 850 |
| 1 | 75 | Northern | 700 |
| 1 | 80 | Thompson-Ryan | 600 |
| 1 | 225 | Crocker-Wheeler | 450 |

### DIRECT CONNECTED SETS

1—25-kw., 220-volt, 3600-r.p.m. General Electric generator, direct connected to Curtis steam turbine.

1—30-kw., 220-volt, 300-r.p.m. Akron generator direct connected to 10 x 10 Buffalo Forge Co. engine, complete.

1—50-kw., 125-volt, 250-r.p.m. General Electric generator, direct connected to 11 x 12 G. E. Marine steam engine, complete.

1—75-kw., 220-volt, 275-r.p.m. Crocker-Wheeler generator, direct connected to a 15 x 16 Harrisburg-Fleming steam engine with balancer set.

1—100-kw., 220-volt, 250-r.p.m. Crocker Wheeler generator, direct connected to a 10 x 16 x 14 simple compound horizontal Ball engine.

### ALTERNATORS

1—50-kva., 2200-volt, 60-cycle, 3-phase 1200-r.p.m. Westinghouse alternator, complete.

2—60-kw., 2300-volt, 60-cycle, 3-phase, 300-r.p.m. Fairbanks-Morse alternator engine type with flange and one bearing.

1—62½-kw., 2200-volt, 60-cycle, 3-phase, 300-r.p.m. Bullock alternator, direct connected to an Aimes steam engine, all complete.

1—75-kva., 2300-volt, 60-cycle, 1-phase, 900-r.p.m. General Electric alternator complete.

1—80-kva., 2300-volt, 60-cycle, 3-phase, 225-r.p.m. Ft. Wayne alternator, direct connected to 110-hp.

Buckeye Producer Gas Engine, complete.

1—85-kva., 2300-volt, 60-cycle, 3-phase, 277-r.p.m. Allis-Chalmers alternator direct connected to an Erie City steam engine, 12 x 12, all complete.

1—100-kva., 2300-volt, 60-cycle, 3-phase, 277-r.p.m. Westinghouse alternator, direct connected to 125-hp. Erie engine.

1—150-kva., 2300-volt, 60-cycle, 3-phase 200-r.p.m. General Electric alternator, direct connected to a 14½ x 24 x 18 Mansfield automatic steam engine, complete.

1—150-kva., 2300-volt, 60-cycle, 3-phase, 720-r. p.m. Electric Machinery, alternator, complete with exciter.

# "HONESTLY REBUILT" ELECTRICAL MACHINERY

**You can purchase our product with the same assurance that you would buy New Electrical Machiuery. For all practical purposes it is just as good.**

## *Don't Pay Premium Prices. The war is over. Buy Rebuilt Motors at Pre-war Prices.*

### Single Phase, 60 Cycle Motors

| H.P. | | Make | Volts | Type | Speed |
|---|---|---|---|---|---|
| 20 | ¼ | Westinghouse | 110/220 | CA | 1725 |
| 3 | ¼ | Robbins & My | 110/220 | P | 1750 |
| | ¼ | General Elec. | 220 | RI | 900/1800 |
| 10 | ¼ | Westinghouse | 110/220 | CA | 1725 |
| | 1 | Century | 110/220 | P | 870 |
| 2 | 3 | Century | 110/220 | P | 1750 |
| | 3 | ½ Century | 110/220 | P | 1165 |
| | 5 | Bell | 110/220 | | 1200 |
| 2 | 5 | Westinghouse | 110/220 | AR | 1750 |
| | 5 | General Elec. | 110/220 | RI | 1800 |
| | 5 | Ideal | 110/220 | AK | 1720 |
| | 7½ | Westinghouse | 110/220 | AR | 1750 |
| 20 | ½ | Vandorn | 220 | DAoo | 1450 |
| | | Universal D.C. A.C. Portable Drills | | | |
| 5 | ½ | Vandorn | 220 | DA-o | 900 |
| | | Universal D.C. A.C. Portable Drills | | | |

### 2 and 3 Phase, 60 Cycle Motors

| | | | | | |
|---|---|---|---|---|---|
| | ¼ | General Elec. | 220 | DST | 1200 |
| | ¼ | Watson | 220 | K | 1720 |
| | ¼ | Fort Wayne | 220 | MA. Vert. | 1200 |
| 2 | 1 | General Elec. | 220 | KQ | 1800 |
| | 1 | General Elec. | 440 | KT | 1800 |
| | 1½ | Fort Wayne | 220 | MA. Vert | 1200 |
| 4 | 1½ | General Elec. | 220 | KT | 1800 |
| 2 | 2 | General Elec. | 220 | KQ | 1800 |
| | 2 | General Elec. | 220 | KT | 1200 |
| 2 | 2 | Westinghouse | 220 | CCL | 1120 |
| | 3 | Westinghouse | 220 | CS | 1730 |
| | 3 | Watson | 220 | KH | 1720 |
| | 3 | General Elec. | 220 | KT | 900 |
| | 3 | Western Elec. | 220 | | 900 |
| | | With 36in. Exhaust Fan | | | |
| | 5 | Genera. Elec. | 220 | KQ | 1200 |
| 2 | 5 | General Elec. | 220 | KQ | 1800 |
| 2 | 5 | Watson | 220 | KH | 1720 |
| 5 | 5 | General Elec. | 220 | KT | 1800 |
| 3 | 7½ | General Elec. | 220/440 | MTC Slip rg | 1200 |

### 2 and 3 Phase, 60 Cycle Motors

| | | | | | |
|---|---|---|---|---|---|
| | 7½ | Westinghouse | 220 | CCL | 840 |
| | 7½ | Burke | 220 | EB | 1800 |
| 3 | 7½ | Watson | 220 | KH | 1730 |
| | 7½ | Rob. & Myers | 440 | K | 1150 |
| | 7½ | Allis-Chalm. | 220 | AN | 1150 |
| | 7½ | Watson | 220 | KH | 1140 |

| HP. | Make | Volts | Type | Speed |
|---|---|---|---|---|
| 10 | Westinghouse | 220 | CCL | 1700 |
| 10 | General Elec. | 220 | IK | 1200 |
| 10 | Western | 220 | Q | 1140 |
| 6 10 | Watson | 220 | KH | 1140 |
| 2 10 | Watson | 220/440 | KH. slip rg. | 1140 |
| 10 | Fairbanks | 220 | B | 1800 |
| 2 10 | Watson | 220 | KH | 1720 |
| 15 | Watson | 220 | KH | 1720 |
| 15 | Watson | 220 | KH | 1140 |
| 4 15 | Westinghouse | 220 | CCL | 850 |
| 15 | General Elec. | 220 | IM. slip rg | 1200 |
| 3 15 | Westinghouse | 220 | CCL | 1140 |
| 2 20 | Fairbanks | 220 | B | 1200 |
| 20 | Watson | 220 | KH | 1140 |
| 25 | Crocker-Wh. | 2200 | | 1200 |
| 25 | Westinghouse | 220 | CCL | 1135 |
| 25 | Watson | 220 | KH | 1140 |
| 25 | Allis-Chalm. | 440 | AN | 680 |
| 25 | Wagner | 220 | BP | 850 |
| 2 30 | Allis-Chalm. | 220 | AN | 860 |
| 30 | General Elec. | 440 | IL | 720 |
| 3 30 | Westinghouse | 220 | CX | 1120 |
| 30 | Westinghouse | 220 | CX | 850 |
| 30 | Westinghouse | 220 | CX | 675 |
| 2 35 | General Elec. | 220 | IK | 720 |
| 40 | General Elec. | 220 | IK | 1200 |
| 40 | Westinghouse | 220 | CCL | 840 |
| 4 50 | Westinghouse | 220 | CX | 840 |
| 50 | Westinghouse | 220 | CX | 1120 |
| 2 50 | Westinghouse | 220 | CCL | 850 |
| 50 | Allis-Chalm. | 220 | AN | 850 |
| 2 75 | Westinghouse | 220 | CCL | 685 |
| 75 | Burke | 2300 | Slip Ring | 720 |
| 100 | Burke | 2300 | Slip Ring | 720 |
| 100 | General Elec. | 220 | 1L | 720 |

### 2 and 3 Phase, 60 Cycle Motors

| HP. | Make | Volts | Type | Speed |
|---|---|---|---|---|
| 175 | Allis-Chalm. | 2300 | ANY slip ring | 860 |
| 200 | Westinghouse | 440 | CCL | 1140 |
| 200 | Westinghouse | 440 | CCL | 900 |
| 6 200 | General Elec. | 440 | IK | 600 |

### 3 Phase, 25 Cycle Motors

| | | | | |
|---|---|---|---|---|
| 1 | General Elect. | 110 | KS | 1500 |
| 37 | General Elec. | 220/440 | ITC slip ring | 750 |
| 3 52 | General Elec. | 220/440 | ITC slip ring | 750 |

### Transformers

2 Kw. Pittsburgh 1 ph., 60 cycle, 220/110 volts
5 Kw. Westing. 1 ph., 60 cycle, 260/240/220/154 volts
10 Kva. Westing. 1 ph., 60 cy., 2200/1980/220 v.
10 Kva., Gen. Elec. 1 ph., 60 cy., 1100/2200/110-220 volts
15 Kva. Westing. 1 ph., 60 cy., 4600-4000/220-110 volts
3 75 Kw. Gen. Elec. 1 ph., 60 cy., Type H-RP, 2300-2145-2070 370-185 volts
3 100 Kva Westing. 1 ph., 60 cy., OIWC 13,200-12,600-12,000-11,400/465-45/437 423 volt

### Rotaries and Motor Generators

15 Kw., 125 v., D.C. Westinghouse, 3 phase, 60 cycle, 220 v., A.C. Motor Generator set
25 Kw., 250 volt., D.C. General Electric, 3 phase, 60 cycle, 2300 v., Motor Generator set
100 Kw., 250 volt, D.C. Westinghose, 3 phase, 60 cycle, 4000 v., A.C. Motor Generator set
100 Kw., 600 volt, D.C. General Electric, 3 phase, 60 cycle, 2300 v., A.C. Rotary, with transformers
3—150 Kw., 250 volt, D.C. General Electric, 3 phase, 60 cycle, 2300 v. Motor Generator sets—New

ALSO—A CAREFULLY SELECTED STOCK OF DIRECT CURRENT MOTORS and GENERATORS

PITTSBURGH'S ELECTRICAL CLEARING HOUSE

ESTABLISHED 1908

## MILLER-OWEN ELECTRIC CO., Inc., LEXINGTON AVE. AND THOMAS BOULEVARD PITTSBURGH, PENNA.

*We cordially invite inspection of our new Warehouse, Salesroom and Shop*

# New Electric Motors

## *Largest Stock in America*

**Also slightly used.**
**Immediate delivery.**
**What do you want?**

## Very Low Prices

**Every motor guaranteed one year. You take no chances.**

**Nathan Klein & Company,** Howard and Centre Sts. New York City

### 60-CYCLE, 3-PHASE, 2300-VOLTS

240-kva., G. E., dir. con. Harrisburg engine, $6500.
75-kw., G. E., dir. con. Erie engine, $2500.
2—50-kw. Wghse, dir. con. Erie engine, $2000.

| Kw. | Generator | Speed | Each |
|---|---|---|---|
| 200 | G. E. | 600 | $1750 |
| 200 | Al. Chal. | 900 | 1500 |
| 150 | Elec. Mchy. | 720 | 1000 |
| 120 | Wghse. | 900 | $1000 |
| 115 | Al. Chal. | 900 | 1000 |
| 100 | W. E. | 600 | 800 |
| 100 | Ft. Wayne | 1200 | 750 |
| 75 | Wghse. | 900 | 750 |
| 48 | Elec. Mchy. | 900 | 550 |
| 20 | Wagner | 1200 | 540 |

### BOILERS

| Hp. | Make | Pressure | Price |
|---|---|---|---|
| 1—500 | B & W | 150 | $7500 |
| 2—350 | Heine | 150 | 4550 |
| 1—300 | Heine | 150 | 3900 |
| 2—264 | B. & W. | 160 | $3200 |
| 1—185 | Manning | 150 | 1400 |

### D.C. UNITS, 250-VOLTS

| Kw. | Generator | Engine | Each |
|---|---|---|---|
| 130 | W. E. | Buckeye | $3500 |
| 100 | Ridgway | Ridgway | 2500 |
| 60 | Al. Chal. | Watertown | 1500 |
| 57½ | G. E., 3-wire | Reeves | 1600 |
| 50 | Al. Chal. | Chand. Tay. | 1400 |
| 50 | C. W. | Frost | $1200 |
| 30 | Sprague | Harrisburg | 1200 |
| 25 | G. E. | A. & S. | 700 |
| 20 | W. E. | Union I. W. | 650 |

**POWER MACHINERY EXCHANGE, Inc.**
**1 Montgomery Street, JERSEY CITY, N. J.**

# READY FOR IMMEDIATE DELIVERY

## ALTERNATING CURRENT

1—1000-hp. Synchronous motor, 2-ph., 60-cy., 2300-v., 300 r.p.m., General Electric, type AQB.
1—95-hp., 2-ph., 60-cy., 2300-v., 675 r.p.m., slip ring, General Electric motor, one-half hour rating, complete.
1—450-hp., 3-ph., 40-cy., 550-v., 400 r.p.m., General Electric, slip ring motor.
1—150-hp., 550-v., 500 speed, General Electric, type I, form M, new slip ring motor.
1—225-hp., 3-ph., 60-cy., 550 v., 514 r.p.m., General Electric, form L motor.
1—300-kw., 3-ph., 40-cy., 2300-v., 600 r.p.m., General Electric, type ATB generator.
1—150-kw., 3-ph., 40-cy., 2300-v., 300 r.p.m., General Electric, type ATB generator.
1—200-kw., 3-ph., 60-cy., 1150-v., 600 r.p.m., type ATB, form D generator.
1—125-kw., 3-ph., 60-cy., 2300-v., General Electric generator, type ATB, 900 r.p.m.
2—220-kw., 2-ph., 60-cy., 2300-v., 600 r.p.m., Stanley Inducted type generators.

## ENGINES

1—13 x 14 Ames automatic, fly-wheel governor.
1—13 x 15 Ames, two years old, throttling governor.
1—13 x 18 Harrisburg automatic, fly-wheel governor.
1—14 and 28 x 18 Stearns cross compound vertical automatic, fly-wheel governor.
1—15 and 25 x 20 Stearns tandem compound automatic, fly-wheel governor.
1—18 and 31 x 30 Stearns tandem compound automatic, fly-wheel governor.
1—24 x 48 Harris Corliss, 150 lb. steam, used three years, 80 r.p.m.
1—20 x 42 Harris Corliss, 150 lb. steam, 100 r.p.m., with Brown valve gear, used one year.
1—14 x 36 Corliss, 7 years old.
1—Vulcan dinkey locomotive engine, 36-in. gauge, size 8 x 14.

## LARGE STOCK OF NEW A. C. MOTORS, 3-ph., 60-cy., 550-v.

1—325-kw., 550-v., Westinghouse direct current generator, 125 r.p.m., direct connected to Fitchburg Cross Compound engine, complete with switchboard and condenser.

## BOILERS

2—66-in. x 17-ft. 6-in. horizontal return tubular boilers, quadruple butt, built in 1914, Mass. standard, good for 165 lb.
2—72-in. x 17-ft. 6-in. horizontal return tubular boilers, quadruple butt, built in 1910, Mass. standard, good for 160 lb.
1—700-hp. Maxum water tube boiler, 2-drum type, built in 1911, used eight months, can be reset for 180 lb., complete.
1—250-hp. Stirling water tube boiler, Mass. standard, built in 1911, 160-lb. pressure.
5—150-hp. Manning boilers, now located in N. H., good for 135/140 lb.
2—78-in. x 21-ft. 6-in. horizontal return tubular boilers, quadruple butt, good for 150 lb., very little used.
2—72-in. x 19-ft. 6-in. horizontal return tubular boilers, triple riveted, built in 1903, 115 lb.

Send us Your Inquiries.

**JOSEPH MYERSON, 274 Commercial Street, Boston, Mass.**

---

FOR SALE

**Direct Connected Alternating Current Generating Unit**

# GENERATOR

1000 kva. General Electric type ATB, class 72, 3 phase, 60 cycle, 2300 volt, 100 r.p.m.

# ENGINE

McIntosh & Seymour horizontal heavy duty type cross compound, size 24 x 48 x 48, 100 r.p.m., steam pressure 125-160 lb.

**Above unit in first-class operative condition. Available immediate shipment from stock.**

***The***

**National Power Machinery Co.**

**1914-1918 Scranton Road, Cleveland, Ohio**

---

## *For Quick Sale! Ready Now!!*

### MOTORS

1—200 H.P., 110 volt, D.C.
1—150 H.P., 220-440 volt, 60 cycle, 3 phase, squirrel cage
1—100 H.P., 110 volt direct current card
1—150 H.P. Fairbanks-Morse type "B," 440 volt, speed 900
1— 20 H.P. Fairbanks-Morse, 440 volt, type "P," speed 1800
1—200 H.P. Crocker Wheeler, type C.C.M., 1440 amp., speed 500; Cutler Hammer starter
1—100 H.P. Card type "S," 600 amp., speed 675
1— 30 H.P.C. & C. type "S," 220 amp., speed 520
20—Westinghouse, 16 H.P., 1725 R.P.M., 230 volt, D.C.
1— 50 H.P. Westinghouse motor, 175 amp., 565 R.P.M., 230 volt, D.C.

### GENERATOR SETS

1—No. K8 C. & G. Electric Co. 125 kw., 125 volt, D.C. generator; direct connected to Ames center crank, automatic cut-off, high speed self-contained engine; 17 in. x 16 in. cylinder
1—300 kw. General electric rotary converter. Type TC-4; form K; 25 cycle, 600 volt; 500 amp. continuous current; speed 750 rev.
3—110 kw. General Electric transformers; type "H," form CP; 25 cycle, 13, 200, 12, 540, 11, 880, 185, 370 volts
1—Triumph 150 kw., 250 volt, D.C. electric generator with 16 x 21 Chuse 4-valve engine, complete with switchboard

### INSULATORS

2000—13,000 volt 3 petticoat porcelain insulators

### COPPER WIRE

50,000 ft. 4/0 grooved copper trolley wire
5 miles 4/0 bare copper wire
9 miles 3/0 round bare copper wire
10,000 ft. 350,000 C.M. stranded cable
10,000 ft. 400,000 C.M. stranded cable
30 miles medium drawn, high tension bare copper wire, size 4

### BOILERS

1—350 H.P. Upright Rush water tube boiler
7—250 H.P. Cahall vertical boilers, Rooney stokers; 160 lb. pressure
2—360 H.P. Atlas water tube; shaker grates; 150 lb. pressure
2—125 H.P. Marine boilers, 125 lb. pressure
2—80 H.P. firebox boilers; 90 lb. pressure
4—72 x 18 ft. triple riveted; butt strapped; 125 lb. pressure
2—66 x 16 ft. triple riveted; butt strapped; 125 lb. pressure

### COMPLETE POWER PLANT

4—72 x 18 ft. triple riveted butt strapped boilers, with Sturtevant mechanical draft, coal handling and weighing apparatus

### SMOKE STACK

1—72 in. x 140 ft.
1—60 in. x 100 ft.
1—48 in. x 100 ft.
1—36 in. x 180 ft.
6—24 in. x 50 ft.
5—72 in. x 90 ft.
1—54 in. x 60 ft.
5—42 in. x 60 ft. to 70 ft.
5—30 in. x 70 ft.
20—20 in. x 60 ft. to 90 ft.

Can furnish these stacks in required lengths.

*Ask for our Machinery Bulletin E. W. 306.*

**HARRIS BROTHERS CO., CHICAGO**

## ALTERNATING-CURRENT MOTORS

| H.P. | Make | Volt | Phase | Cycle | Type | Speed | |
|---|---|---|---|---|---|---|---|
| 1—10 | General Electric | 220 | 2 | 60 | L | 1200 | |
| 1—10 | General Electric | 220 | 3 | 60 | K | 1800 | |
| 1—15 | General Electric | 220 | 3 | 60 | Form-L | 1200 | |
| 1—20 | General Electric | 220 | 3 | 60 | K | 1200 | |
| 1—25 | General Electric | 220 | 3 | 60 | K | 1200 | |
| 1—20 | Westinghouse | 220 | 3 | 60 | F | 850 | Slip ring |
| 1—25 | Allis-Chalmers | 220 | 3 | 60 | | 850 | Slip ring |
| 1—50 | General Electric | 220 | 3 | 60 | L | 900 | |
| 1—75 | Westinghouse | 220 | 3 | 60 | C.C.L. | 685 | |
| 1—7½ | Wagner | 110-220 | 1 | 60 | A.C. | 1800 | Slip ring |
| 1—10 | Wagner | 110-220 | 1 | 60 | B.A. | 1800 | |
| 1—15 | Wagner | 220 | 1 | 60 | A.C. | 1200 | |

1—2500-ampere Plating Generator Double Commutator

## DIRECT-CURRENT MOTORS

| H.P. | Make | Volt | Speed | Type |
|---|---|---|---|---|
| 1— 5 | Peerless | 110 | 1050 | C.M. |
| 3— 7½ | Crocker-Wheeler | 110 | 850 | |
| 1— 10 | Crocker-Wheeler | 110 | 850 | C.M. |
| 1— 10 | Westinghouse | 110 | 1350 | S. |
| 1—15 | Western Electric | 220 | 500 | |
| 1—15 | General Electric | 220 | 1100 | C.E. |
| 1—15 | Fairbanks-Morse | 500 | 850 | |
| 1—15 | Fairbanks-Morse | 220 | 850 | |
| 1—25 | Western Electric | 220 | 650 | |
| 1—25 | Northern | 110 | 950 | |
| 1—25 | Akron | 110 | 900 | |
| 1—35 | Fairbanks-Morse | 500 | 650 | |
| 1—35 | Fairbanks-Morse | 220 | 650 | |
| 1—75 | Crocker-Wheeler | 125 | 700 | |
| 1—150 | Berke | 220 | 1100—1300 | |
| 1—45 Kw. | Western-Electric | 125 | 1050 | |
| 1—75 Kw. | Crocker-Wheeler | 125 | 700 | C.C.M |

**MONARCH ELECTRIC MOTOR CO.**
**166 Centre St., cor. Canal, New York City**

# MOTORS

Most of these motors were **NEW LAST MARCH** and were **IN USE UNTIL AUGUST.** Be sure to investigate these offers before buying elsewhere.

### *Immediate Shipment*

| No. | Hp. | Make | R.p.m. | Volts | Winding | Type |
|---|---|---|---|---|---|---|
| 1 | 75 | Diehl | 700 | 220 | Interpole CW | K |
| 1 | 50 | G. E. | 650 | 230 | Shunt | CLB |
| 1 | 35 | G. E. | 600 | 230 | Shunt | CLA |
| 1 | 35 | Sprague | 900 | 230 | Interpole CW | LC |
| 1 | 30 | Sprague | 725/1000 | 230 | Interpole CW | LC |
| 1 | 25 | Sprague | 750/1000 | 230 | Interpole CW | LC |
| 1 | 25 | Westghse | 630 | 220 | | S |
| 1 | 20 | Sprague | 1050 | 230 | C. W. | D |
| 1 | 15 | Sprague | 625/1250 | 230 | Interpole CW | CQ |
| 1 | 15 | G. E. | 1000 | 230 | C. W. | CQ |
| 1 | 15 | G. E. | 1100 | 230 | Shunt | CE |
| 1 | 15 | Westghse | 600 | 230 | Shunt | S |
| 2 | 15 | G. E. | 800 | 230 | Shunt | RC |
| 1 | 7½ | G. E. | 1500 | 230 | | CVC |
| 1 | 7½ | Diehl | 1400 | 230 | Shunt | G |
| 3 | 5 | G. E. | 1100 | 230 | Shunt | CQ |
| 2 | 5 | Sprague | 1150 | 230 | R. T. | |

Single-phase, 60-cycle, 110/220-volt, 1750-r.p.m. Emerson New Motors.
10—1-hp. . . . . at $75 12—1½-hp. . . . . at $90
8—2-hp. . . . . at $106

1—25-hp. G. E., 3-phase, 60-cycle, 440-volt, 1200-r.p.m.
1—15-hp. G. E., 3-phase, 60-cycle, 220-volt, 1200-r.p.m.
1—10-hp. W. E., 3-phase, 60-cycle, 220-volt, 1700-r.p.m.
2— 5-hp. Westinghouse, 3-phase, 60-cycle, 220-volt, 1700-r.p.m.
8—7½-hp. Westinghouse, 2-phase, 60-cycle, 220-volt, 1740-r.p.m.
5—5 -hp. G. E., 2-phase, 60-cycle, 220-volt, 1200-r.p.m.

**LARGE STOCK OTHER MOTORS — VARIOUS MAKES AND SIZES**

***We Also Buy Motors and Dynamos***

**Reliable Electric Motor Co.**
**Grand and Centre Sts., New York City**

## HAROLD R. WILSON MACHINERY CO.

Federal Reserve Bank Building, ST. LOUIS, MO.

**Electric and Steam Heat Machinery Second Hand**

**DIRECT CONNECTED A C UNITS (60 CYCLES)**

| | Kw. | Make | Volts | Ph. | Engine Description |
|---|---|---|---|---|---|
| | 1500 | Westge. | 2400 | 2 or 3 | to Westinghouse St. Turbine |
| 3— | 800 | G. E. | 2300 | 3 | MacI & Sey. C.C. Horizontal Engines |
| | 600 | Westge. | 2200 | 2 or 3 | Lane & Bodley C. C. Corliss |
| | 600 | G. E. | 2300 | 3 | to 30 x 48 Hamilton Corliss |
| 2— | 600 | C. G. E. | 2300 | 3 | to R. & S., C. C. Corliss |
| | 450 | G. E. | 2300 | 3 | Allen C. C. Corliss Horizontal |
| | 300 | Stanley | 440 | 3 | to C Compound Mac. I. & Seymour |
| | 300 | G. E. | 2200 | 2 or 3 | to T. & C. Wheelock |
| | 250 | G. E. | 240 | 3 | 19 x 20 Skinner, 200 R.P.M. |
| | 240 | Stanley | 2300 | 2 or 3 | to 19 x 30 Buckeye |
| | 200 | G. E. | 2200 | 3 | Mc I. & Seymour, 4-Valve |
| | 180 | Westge. | 220 | 3 | 18 x 26 H. S. G. Belted |
| | 175 | Westge. | 480 | 2 or 3 | 18 x 20 Murray Uniflow |
| | 125 | G. E. | 2300 | 3 | to G. E. Curtis St. Turbine |
| | 125 | Burke | 2300 | 3 | MacI. & Seymour, 4-Valve |
| | 100 | Westge. | 440 | 3 | to 12 and 22 x 13 Westinghouse V. C.C. |
| 2— | 100 | G. E. | 2300 | 3 | to Curtis Turb., 1 Cond., 1 Non-Cond. |
| | 60 | Westge. | 240 | 3 | De Laval St. Turbine, 1200 R.P.M. |

**Other Sizes—Also A.C. & D.C. Belted Dynamos, Motors, ENGINES—BOILERS—ROTARIES—ELECTRIC CARS, Etc.**
**We probably have just what you require—Try us.**

## GEORGE FRANCIS ADAMS

**30 Church Street, New York, N. Y.**

100 H.P. new Burke Electric 220 or 440 V., 60 cy., 2 ph., 900 R.P.M. slip ring type Motor, complete with C.H. drum type starter.

**DIRECT CURRENT MOTORS AND GENERATORS**

| No. | H.P. | Speed | 230 v. Winding | Make |
|---|---|---|---|---|
| 1 | 29 | 1600-1750 | Shunt | General Electric |
| 1 | 45 | 1700 | Shunt | Crocker-Wheeler |
| 1 | 53 | 500 | Compound | Keystone Electric |
| 3 | 60 | 850 | Shunt | Burke Electric |
| 1 | 75 | 500 | Compound | Keystone Electric |
| 1 | 100 | 480 | Compound | Keystone Electric |
| 5 | 200 | 375 | Shunt | Burke Electric |

2—500 Kw. Engine Generator Sets, 250 v., D.C., Ball-Burke Electric

# LARGE SLIP RING MOTORS FOR IMMEDIATE DELIVERY

1— 50-hp., 3 phase, 60 cyc., 2200 v., 900 r.p.m.
1— 75-hp., 3 phase, 60 cyc., 2200 v., 900 r.p.m.
1—100-hp., 3 phase, 60 cyc., 220/440 v., 900 r.p.m.
1—150-hp., 3 phase, 60 cyc., 220/440 v., 600 r.p.m.
2—200-hp., 3 phase, 60 cyc., 2200 v., 600 r.p.m.

**300 kw., 3 bearing belt driven railway generator, 435 r.p.m.**

17—7½-kw., 125-volt Gasoline **Engine-Generator Sets.** These are complete units, equipped with Governor, Buda, 4-cylinder Engine and General Electric, 900 r.p.m. Generator.

## LEO A. PHILLIPS, 90 West Street, New York City

# TRANSFORMERS

FOR SALE

2—3750-kva., indoor, water-cooled, General Electric, type WC, form EITQ, 60-cycle, arranged for Scott connection, 13,200 volts, 3-phase, high tension, and 5667 volts, 2-phase, low tension, cooling water required 13 gallons per minute at 100% load; 16 gallons per minute at 125% load; net weight 22,625; weight with oil 33,625; full load efficiency 99.2%; temperature rise above that of the incoming water, full load 30° C. Regulation at 100% power factor .53%, at 80% power factor 3.70%; internal reactance 5.45%; serial numbers 1,065,648-49. In service four years. Available for delivery January 1st, 1919. Can be seen at Station "A-1," 28th and Christian Sts., Philadelphia, upon application.

6—250-kva., Wagner, type 12-ROC, 60 cycles, 5500/-5330/5170 volts high tension, 220/110 volts low tension, oil insulated, self-cooled; net weight 4592 lbs.; weight with oil 6652 lbs.; full load efficiency 98.5%; regulation 100% power factor .83%; 80% power factor 3%; temperature rise in degrees Centigrade, full load continuously 50°; 1¼ loads continuously 65°; 1½ load for one hour 60°. These transformers are not arranged to give any other voltages than those mentioned. The secondaries can be re-wound for 220/440 volts. The primary side cannot be reconnected for 2300 volts. They can be re-wound so that they can be used on a primary circuit of 11,000 volts. Can furnish with or without oil. Can be seen at 32nd and Jefferson Sts., Philadelphia, upon application.

**The Philadelphia Electric Company**
**Tenth and Chestnut Sts., Philadelphia, Pa.**

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*The* Machinery House of the East

# FRANK TOOMEY, Inc.

1876 **MOTORS** 1918

## SQUIRREL CAGE, 3-PHASE, 60-CYCLE

200-hp. Westinghouse, type "CCL," 2200-volt, 580-r.p.m.
200-hp. Crocker-Wheeler, 220-volt, 600-r.p.m.
100-h.p. Westinghouse, type "CCL," 220-volt, 495-r.p.m.
40-hp. Fairbanks-Morse, 220-volt, 900-r.p.m.
40-hp. General Electric, type "K.T.," 220-volt, 690-r.p.m.
25-hp. General Electric, form "K," direct air 440-volt., 1200-r.p.m.
25-hp. General Electric, form "K," 220-volt, 1200-r.p.m.
25-hp. Westinghouse, type "C," 220-volt, 1120-r.p.m.
20-hp. General Electric, form "KT," 1800-r.p.m.
20-hp. General Electric, form "L," 550-volt, 1800-r.p.m.
15-hp. General Electric, form "K," 220-volt, 1200-r.p.m.
15-hp. Crocker-Wheeler, 220-volt, 1200-r.p.m.

## 3-PHASE, 60-CYCLE SLIP RING

250-hp. Westinghouse type "HF," 220-440-volt, 580-r.p.m.
75-hp. Westinghouse, type "HF," 220-440-volt, 1120-r.p.m.
50-hp. Westinghouse, type "HF," 220-440-volt, 850-r.p.m.
40-hp. Crocker-Wheeler, 220-volt, 1200-r.p.m.

## 2-PHASE, 60-CYCLE, SQUIRREL CAGE

100-hp. Allis-Chalmers, type "AN," 220-550-volt, 680-r.p.m.
75-hp. General Electric, form "L," 220-volt, 720-r.p.m.
50-hp. General Electric, form "K," 200-volt, 900-r.p.m.
3—25-hp. General Electric, 220-volt, 600-r.p.m.
20-hp. Ideal, 220-volt, 600-r.p.m.
20-hp. Allis-Chalmers, 220-volt, 850-r.p.m.
15-hp. Robbins & Myers, 220-volt, 1160-r.p.m.

## DIRECT CURRENT, 220-250-VOLT

165-hp. Crocker-Wheeler, type "CM," 685-r.p.m.
50-hp. Westinghouse, type "M," 675-r.p.m.
**Also large stock of smaller sizes.** 110-220-volt, standard makes.

*Send for complete stock list.*

**127-131 N. Third Street**
**PHILADELPHIA, PA.**

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# General Equipment Company Offer for Sale

### TURBO GENERATORS

1—400-kw. Westinghouse Turbo Generator, 60-cycle, 2300-volt, wound 2-phase, reconnected 3-phase, with starting rheostat.
2—500-kw. G. E. Vertical, 3-phase, 60-cycle, 2300-volt, with oil pumps, dry vacuum and hot well pumps.

### ENGINE AND GENERATORS

1—429-hp. Buckeye Gas Engine, direct connected to Crocker-Wheeler, 250-kw., 3-phase, 60-cycle, 2300-volt generator.
1—Russell Tandem Compound, 23 and 27 x 24-in., with 150-kw., 3-phase, 60-cycle, 2300-volt, Fort Wayne Generator, with 10-kw. Fort Wayne, 120-volt exciter.
1—McIntosh and Seymour, 14 x 28 x 30-in. tandem compound, direct connected to 300-kw., 3-phase, 60-cycle, 2300-volt G. E. Generator, 150-r.p.m., 17-kw. exciter, Worthington jet condenser.
1—18 x 48-in. Murray Corliss Engine, belt connected to 150-kw. Stanley, 3-phase, 60-cycle, 2300-volt Generator, 17-kw. exciter.
1—12 x 24-in. Fitchburg Corliss Engine, belt connected to 1 Warren, 60-kw., single phase, 60-cycle, 2300-volt, 720-r.p.m. Generator, with exciter.

### GENERATORS

1—150-kw. Corliss-Wheeler, 3-phase, 60-cycle, 2300-volt, revolving field engine type of Alternator, with engine shaft 225-r.p.m.
1—200-kw. Crocker-Wheeler, 3-phase, 60-cycle, 2300-volt, revolving field engine type of Alternator, 200-r.p.m., with exciter and engine shaft.

### MOTORS

1—Westinghouse, 30-hp., 125-volt, D.C. Motor.

### MISCELLANEOUS ELECTRICAL AND STEAM EQUIPMENT

1—Ames, 12 x 14-in., 150-hp. Engine.
1—Cochrane Feed Water Heater, 8-in. exhaust, 4-in. inlet.
1—2½ x 4-in. Goulds Triplex Pump.
1—Struthers-Wells Gas Producer, with blower, air compressor and tank.
1—150-hp., 3-cylinder Gas Engine, with 115-kw., 3-phase, 60-cycle, 2300-volt generator, with exciter and switchboard.
Fare Boxes, Trolley Wheels, K-14 Controllers, Oil Switches, Panels, Meters.
1—Leeds and Northrup set of Standardization Apparatus.

*Send us your inquiries.*

**GENERAL EQUIPMENT CO., 30 Church St., New York City**

---

## *IMMEDIATE DELIVERY*

# MOTORS

3—75 H.P. Fairbanks-Morse 2-Ph., 220-V., 60-Cy., 900 R.P.M.
4—50 H.P. Fairbanks-Morse 3-Ph., 220-V., 60-Cy., 900 R.P.M.
4—50 H.P. Fairbanks-Morse 2-Ph., 220-V., 60-Cy., 900 R.P.M.
1—50 H.P. C. & C. 220-V. Direct Current, 725 R.P.M.
1—35 H.P. General Electric 220-V., Direct Current, 560 R.P.M.
1—30 H.P. Wagner Single-Ph., 220-V., 60-Cy., 1200 R.P.M.
1—30 H.P. Triumph 2-Ph., 220-V., 60-Cy., 1140 R.P.M.
4—25 H.P. Fairbanks-Morse 2-Ph., 220-V., 60-Cy., 900-R.P.M.
3—25 H.P. Fairbanks-Morse 2-Ph., 220-V., 60-Cy., 1200-R.P.M.
2—25 H.P. Fairbanks-Morse 3-Ph., 220 V., 60-Cy., 900-R.P.M.
1—20 H.P. General Electric 3-Ph., 550-V., 60-Cy., 900-R.P.M.
1—20 H.P. GeneralElectric 3-Ph., 220 V., 60-Cy., 1200-R.P.M.
3—20 H.P. General Electric 2-Ph., 220- V., 60-Cy., 1200-R.P.M.
5—20 H.P. Fairbanks-Morse 2-Ph., 220-V., 60-Cy., 1200-R.P.M.
5—15 H.P. Fairbanks-Morse 2-Ph., 220-V., 60-Cy., 1200-R.P.M.
2—15 H.P. Fairbanks-Morse 2-Ph., 220-V., 60-Cy., 1800-R.P.M.
1—15 H.P. Westinghouse 2-Ph., 220- V., 60-Cy., 1200-R.P.M.
2—15 H.P. General Electric 2-Ph., 220- V., 60-Cy., 1200-R.P.M.
1—15 H.P. Sturtevant D.C. 125-V., 150/450-R.P.M. (shunt interpole)
1—15 H.P. Fairbanks-Morse 3-Ph., 220-V., 60-Cy., 900-R.P.M. (slip ring)
1—15 H.P. Fairbanks-Morse D.C., 230-V., 1100-R.P.M.
4—10 H.P. Fairbanks-Morse 2-Ph., 220-V., 60-Cy., 900-R.P.M.
4—10 H.P. Fairbanks-Morse 2-Ph., 220-V., 60-Cy., 1200-R.P.M.
1—10 H.P. General Electric 110-V., D.C., 700-R.P.M.

# GENERATORS

1—75 Kw. Crocker-Wheeler D.C. 220-V., direct connected to American Ball Engine
1—75 Kva. Western Electric 2-Ph., 220-V., 60-Cy., 720-R.P.M., with exciter (new)
1—60-Kw. Stanley 2-Ph., 60-Cy., 900-R.P.M., with exciter and switchboard
1—50 Kw. Westinghouse 2-Ph., 220-V., 60-Cy., 900-R.P.M., with exciter and switchboard
1—50 Kw. Western Electric Generator, 120-V., D.C., 265-R.P.M., 6-Pole, compound, direct connected to an Ideal centercrank Harrisburg engine, complete with switchboard
1—11 Kw. Western Electric 110 V., D.C., compound, 1150-R.P.M.

Large stock of other sizes of A.C. and D.C. Motors and Plating Dynamos

***Write—Phone—Wire Your Requirements***

**BROWN-HUNKELE CORPORATION**
12, 24, 26 Mechanic St., Newark, N. J.

# FIRST-CLASS USED EQUIPMENT

***Immediate Release***

## TURBINES

1—2500/3125-kw. Westinghouse, 3600-r.p.m., DF, 175-lb. pressure, 3-phase, 60-cycle, 4600-volt, 7000-sq.ft. Wheeler Condenser & Engineering Company Surface Condenser, engine driven auxiliary.

1—750/1000-kw. Westinghouse, 3600-r.p.m., SF, 175-lb. pressure, 3-phase, 60-cycle, 4600-volt LaBlanc Jet Condenser, turbine driven auxiliary.

1—2000/2500-kw. General Electric, 1800-r.p.m., 150-lb. pressure, 3-phase, 60-cycle, 2300-volt, 6000-sq.ft. C. H. Wheeler Surface Condenser, engine driven auxiliary.

1—750/1000-kw. General Electric, 1800-r.p.m.. 150-lb. pressure, 3-phase, 60-cycle, 2300-volt Alberger Jet Condenser, turbine driven auxiliary.

## BOILERS

2—500-hp. Keeler, Massachusetts Standard, 200-lb., 3 years old, Foster superheaters, 6 retort Riley stokers, Green forced draft fans.

2—500-hp. Porcupine, Massachusetts Standard 160-lb., 6 years old, Universal chain grate stokers.

2—600-hp. Heine, Massachusetts Standard, 175-lb., 6 years old, 6 retort Riley stokers, Green forced draft fans.

2—350-hp. Heine, Massachusetts Standard, 175-lb., 8 years old, 4 retort Riley stokers, Green forced draft fans.

*The above are in two complete modern steam plants with feed pumps, feed water heaters, exciters, piping, stacks, etc., all for sale. This equipment will stand the most rigid inspection.*

**Items 2, 5, and 8 Have Been Sold**

**Greenfield Electric Light & Power Co.**
MONTAGUE CITY, MASS.

# MOTORS

200 H.P. Motor
220 or 440 volt, 3 phase, 60 cycle
Allis-Chalmers
Wound Rotor, Slip Ring
600 R.P.M.

New motor in stock for immediate delivery. Many other motors in stock, send us your inquiries.

**THE O'BRIEN MACHINERY CO.**
119 N. 3rd St., Philadelphia, Pa.

# TURBINES

2—10,000-kw. New Turbo Alternators, with condensing equipment.
1—5000-kw. New Turbo Alternator.
1—5000-kva. Turbo Alternator. With surface condenser.
1—1500-kw. Turbo Alternator. With surface condenser.

## BOILERS

3—400-hp. A. & T. Water Tube Boilers, 150 lb.
4—450-hp. Stirling Boilers, 175 lb. pressure.
2—400-hp. B. & W. Water Tube Boilers, 165 lb.

***We Purchase and Dismantle Complete Plants***
***What Have You for Sale?***

**SUN POWER EQUIPMENT COMPANY**
Commercial Trust Bldg., Philadelphia, Pa.

# IMMEDIATE SHIPMENT NEW STOCK

1—100 kw. DeLaval Turbine set, direct connected to two 50 kw., 110 or 220 volt generators, with switchboard.
1—Westinghouse Automatic compound 9 x 15 x 9 engine, direct connected to a 50 kw., 230 volt, D.C. generator.
1—American Ball engine, direct connected to 50 kw., 230 volt, D.C., 295 r.p.m. generator.
1—Brownell 14 x 12 slide valve engine.
2—50 hp., 500 volt, D.C. Vertical motors, direct connected to Worthington pump.
1—200 kw., 240 volt, 2-phase, 60-cycle, 600 r.p.m. Generator, with exciter and switchboard.
1—200 hp., 550 volt, type SK, 600 r.p.m. Westinghouse motor.
1—150 hp., C & C, D.C., 230 volt, 450 r.p.m. motor.
1—120 hp. Westinghouse, Type S, 230 volt, 750 r.p.m. motor.
1—General Electric, type H, form S.W., 60 cycles, 100 kva., single phase Transformer, 2400 volts primary, 240-120 volts secondary.

**Also 4000 motors in stock, both new and used, alternating and direct current.**

**VENINO BROS. & CO.**
65 Hamilton St., Newark, N. J.

**We are constantly in the market for large generating units, motors, etc.**

WE MAINTAIN THE

Largest Electrical Repair Plant in the United States and Rebuild and Overhaul All Types of Electrical Apparatus

**I. R. NELSON, 1 Bond Street, Newark, N. J.**

*IMMEDIATE SHIPMENT*

# GENERATORS

**125-Volt D. C.**

17½-kw., 350 r.p.m. Triumph Generator, direct connected to 8 x 8-in. Buffalo Forge horizontal Engine on common sub-base, with throttle valve and rheostat.
12½-kw., 1350 r.p.m., Type "MP" General Electric, with pulley, base and rheostat.
6-kw., 1625 r.p.m., 52 ampere Fairbanks-Morse, with pulley, base and rheostat.
60-light, 1050 r.p.m., No. 16 Sterling Model, Non-Flicker Gas Engine Type, with pulley, base and rheostat.
1 New 13-in. x 6-ft. South Bend Lathe, crated for shipment. $350 cash.

**GEO. F. MOTTER'S SONS**
Water and Princess Sts., York, Pa.

# WESTINGHOUSE LEBLANC CONDENSERS

2—Jet type 26,500 lb. steam 28 inches vacuum 70 degree water.

## TURBO-GENERATORS

1—500 kw. 60 cy. 3 ph. 480 volts.
1—1000 kw. 60 cy. 2 ph. 2300 volts.
1—2500 kw. 60 cy. 3 ph. 2300 volts.
1—50 kw. 125/250 volts D.C.

**WILLIAM P. BREW**
Equitable Bldg., New York, N. Y.
Telephone Rector 5890

## MOTORS-DYNAMOS

Write us what you want to buy or sell

**SCHWARTZ & LAND**

**207 Centre Street** **New York**

## MOTORS

1—25 hp. Allis-Chalmers motor, 440 volts, 31 amp., 3-phase, 25-cycle, 720 r.p.m.

1—40 hp. Allis-Chalmers motor, 440 volts, 49 amp., 3-phase, 25-cycle, 720 r.p.m.

**H. E. SALZBERG CO., INC.**
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*Immediate Delivery*

## *New* MOTORS *Used*

**1 to 100 H.P.**

Used Motors, Guaranteed. Send us your requirements. We Buy, Sell and Exchange.

**DAVIS MACHINE & MOTOR CO.**
59 Mechanic St., Newark, N. J.

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2—400-kw. Westinghouse-Parsons A.C. Turbo-Generators, 2-phase, 60-cycle, 220-volt, 3600-r.p.m. Includes: 1—400-ft. Alberger **Surface Condenser**, circulating and hot well **Pumps** and Machine panels for operating same. Can be run as an 800-kw. or 2—400-kw. outfits.

**CONSOLIDATED MACHINERY & WRECKING CO.**
50 Church St., New York City

## BRAND NEW G. E. MOTORS

**IMMEDIATE SHIPMENT**

**220-240 Volt, 3 Phase, 60 Cycle**

| | | | | | |
|---|---|---|---|---|---|
| 1—50-hp., | 720-r.p.m., | Sq. Cage | 5—40-hp., | 1200-r.p.m., | Sq. Cage |
| 1—50-hp., | 900-r.p.m., | Sq. Cage | 3—25-hp., | 900-r.p.m., | Sq. Cage |
| 1—50-hp., | 1200-r.p.m., | Sq. Cage | 1—20-hp., | 900-r.p.m., | Sq. Cage |
| 4—50-hp., | 900-r.p.m., | Sq. Cage | 4—10-hp., | 900-r.p.m., | Sq. Cage |

**RALPH E. GARRITY, 633 Wabash Bldg., Pittsburgh, Pa.**

## DIRECT CONNECTED SETS

**2—8 kw. Crocker-Wheelers, direct connected to Forbes Marine type engines. 650 r.p.m., 115 to 120 volts. Immediate delivery.**

**150 hp. HF Westinghouse, 3 phase, 580 r.p.m., complete with rails, pulley and starter.**

**R. SCHEINERT COMPANY**
**123-25 N. Third St., Philadelphia, Pa.**
**Phone—Bell Market 3881 Keystone, Main 2317**

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1—225-hp. 60-cy. 3-ph. 514 r.p.m. G. E.
1—100 hp. 60-cy. 3-ph. 720 r.p.m. CS West.
1—75 hp. Slip Ring, 550-v. 3-ph. 60-cy.
4—50-hp. 900 r.p.m. Form L 3-ph. 60-cy.

**Large Stock of Other Makes and Sizes**

**A. WERBY & CO.**, 47 Beverly Street, **Boston, Mass.**

*BARGAINS*

## ENGINE GENERATOR SETS

1—50-kw. Allis-Chalmers, 240 volt, 275 r.p.m., D.C. generator, direct connected to a Skinner self-oiling automatic engine, with switchboard.

1—75-kw., Allis-Chalmers, 240 volt, 275 r.p.m., D.C., generator, direct connected to a Skinner self-oiling automatic engine, with switchboard.

**Practically new and available for immediate shipment from here.**

**THE RANDLE MACHINERY CO.,** (Established 34 years)
1822 Powers St., Cincinnati, Ohio

**Our REPAIR SHOPS are known for service and satisfactory work**

***Correspondence Solicited***

**COMMONWEALTH EDISON COMPANY**
**Telephone Randolph 1280**
**[illegible]8 North Market Street, CHICAGO**

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*will find* { The man / The position / The plant } *you want*

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*A MERRY CHRISTMAS* —WISHING YOU— *A HAPPY NEW YEAR*

## GEO. F. MOTTER'S SONS

### STEAM AND ELECTRICAL ENGINEERS

**YORK, PA.**

***DEALERS IN***

**Power Plant Equipment—New and Rebuilt**
**Boiler, Engine, Generator and Motor Repairs**
**Electrical and Mechanical Mill Supplies**
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***INSTALLATIONS EFFICIENTLY MADE***

# *Get your Wants into the Searchlight*

# MOTORS

## IN STOCK

*Immediate Shipment*

**New Gen. Elec. 3-Phase, 60-Cycle**

**Squirrel Cage**

| Hp. | Speed | Volts 220-440 |
|---|---|---|
| 150 | 720 Used Western | 1 |
| 100 | 600 | 1 |
| 100 | 720 | .. |
| 75 | 720 | 2 |
| 75 | 900 | 1 |
| 75 | 1800 | 1 |
| 50 | 900 | 9 |
| 50 | 1200 | 3 |
| 40 | 720 | .. |
| 40 | 900 | 1 |
| 40 | 1200 | 3 |
| 30 | 900 | 2 |
| 30 | 1200 | 3 |
| 25 | 900 | 3 |
| 25 | 1200 | 2 |
| 20 | 900 | 4 |
| 20 | 1200 | 2 |
| 15 | 900 | .. |
| 15 | 1200 | 5 |
| 15 | 1800 | .. |
| 10 | 900 | 4 |
| 10 | 1200 | 1 |
| * 10 | 1800 | .. |
| * 7½ | 900 | .. |
| * 7½ | 1200 | .. |
| 7½ | 1800 | 4 |
| 5 | 900 | 4 |
| 5 | 1200 | 3 |
| 5 | 1800 | 6 |
| 3 | 1200 | .. |
| 3 | 1800 | 5 |
| 2 | 1200 | 3 |
| 2 | 1800 | 4 |
| 1 | 1200 | 3 |
| 1 | 1800 | 1 |

**Slip Ring**

| | | | |
|---|---|---|---|
| * 300 | 514 | 2 | Used |
| 150 | 600 G.E. (Western) | | 1 |
| * 75 | 663 | 1 | .. |
| * 50 | 900 | 1 | .. |
| 25 | 1200 | 1 | .. |

*Detroit stock.

Please note that the major portion of 220-volt induction motors are reconnectable to 440-volts and vice versa.

**Used Direct Current Motors**

| Hp. | Speed | Volts | Make | Qu. |
|---|---|---|---|---|
| 65 | 750 | 230 | Triumph | 1 |
| 50 | 1050 | 250 | Triumph | 1 |
| 20 | 960 | 230 | Triumph | 1 |
| 15 | 900 | 220 | Lincoln | 1 |
| 10 | 650 | 230 | G.E. | 2 |
| 10 | 975 | 220 | Peerless | 1 |
| 10 | 1750 | 110 | Colburn | 1 |
| 7½ | 700 | 220 | Crocker-W | 1 |
| 6 | 560 | 110 | Card | 1 |
| 6 | 1200 | 220 | Lincoln | 1 |
| 5½ | 1150 | 230 | Bennett-O'C | 1 |
| 5 | 950 | 230 | G. E. | 1 |
| 5 | 1700 | 230 | G. E. | 1 |
| 5 | 1700 | 115 | G. E. | 1 |
| 3 | 600 | 110 | Lincoln | 1 |
| 3 | 900/2200 | 220 | Peerless | 1 |
| 3 | 1560 | 110 | Peerless | 1 |
| 3 | 1700 | 500 | Westg | 1 |
| 3 | 1700 | 230 | G. E. | 1 |
| 2 | 750 | 220 | Westg. | 1 |
| 2 | 1100 | 230 | Western | 1 |
| 2 | 1200 | 220 | Ahlm-Edws. | 1 |
| 1½ | 1200 | 220 | Westg. | 1 |
| 1 | 1700 | 230 | G. E. | 1 |
| *150-kw. | 580 | 250 | Crocker-W. | 1 |
| * 75-kw. | 575 | 250 | Western | 1 |
| * 75-kw. | 650 | 125 | Akron | 1 |
| * 75-kw. | 700 | 250 | G. E. | 1 |
| * 10-kw. | 800 | 110 | Sprague | 1 |

*Generator.

**MOTOR GENERATOR SETS**

**Immediate Shipment**

75 kw., 250 volt, 575 r.p.m., USED Western generator with field rheostat, flexibly coupled to 100-hp., 440 v., 3 phase, 60 cycle, 575 r.p.m., NEW General Electric motor with starting compensator.

75-kw., 125 volt., 690 r.p.m. USED Akron generator with switchboard, flexibly coupled to 100-h.p., 220 or 440 volt, 3-phase, 60-cycle, 690 r.p.m., NEW General Electric motor with starting compensator.

All used apparatus listed above is guaranteed to be free from electrical and mechanical defects.

**THE ELLIOTT ELECTRIC COMPANY**

813-815 Superior Avenue West
812-814-830-832 Lohg Avenue,
Cleveland, Ohio

# BRAND NEW GENERATING UNITS

***For Shorter Delivery***

1—180-kva., 60 cycles, 3-phase, 2300 volts, Western Electric alternator, directly connected to simple, non-releasing Corliss engine. With belted exciter.

1—312 kva., 60 cycles, 3-phase, 2300 volts, 200 r.p.m. Western Electric alternator, directly connected to simple, non-releasing Corliss engine. With belted exciter.

2—450 kva., 60 cycles, 3-phase, 2300 volts, 150 r.p.m. General Electric alternators, directly connected to simple, non-releasing Corliss engines. With belted exciter.

1—150 kw., 250-275 volts, 200 r.p.m. General Electric direct current generator, directly connected to simple non-releasing Corliss engine. With standard switchboard.

2—200 kw., 250-275 volts, 200 r.p.m. General Electric direct current generators, directly connected to simple, non-releasing Corliss engines. With standard switchboard.

1—300 kw. 250-275 volts, 200 r.p.m. General Electric, direct current generators, directly connected to simple NRC engines. With standard switchboard.

**H. A. & G. X. CHUSE, Mattoon, Ill.**

# Generating Units

**FOR SALE**

*Ready for Immediate use*

2—240-hp., 225-r.p.m., Tandem Compound Ideal Engines, direct connected to two G. E. Co., 150-kw. Generators — 2300-volt, 60-cycle, and one motor generator exciter set. Address

**R. BENSON**
**Purchasing Agent, C. & W. I. Ry. Co.**
Dearborn Station, Chicago

FOR SALE—Two A-1

# ELECTRIC LIGHT and POWER PLANTS

in two first-class live cities of the Northwest.

BO324—Electrical World
1570 Old Colony Bldg., Chicago, Ill.

FOR SALE

# 4—500 K.W. Stanley Motor Generator Sets

A. C. Synchronous Motors, 2200 volts, 2-phase, 375 r.p.m.

D. C. Generators, 245 volts. Complete switchboard.

**AMERICAN MAGNESIUM CORP.**
Niagara Falls, N. Y.

# Alternating Current Generators and Engines

2—150-kw. General Electric, revolving field, belted, including engines—a complete plant.

1—200-kw. General Electric, direct connected to compound Corliss engine.

*Innumerable others in stock.*

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1218 Chestnut St., Philadelphia, Pa.

FOR SALE

# GENERATING UNIT

Nash two cylinder vertical gasoline or fuel Engine, direct connected to 12½-kw., D.C. Generator, almost new.

**NATHAN KLEIN & CO.**
208 Center St., New York

# GENERATOR

**WANTED**

125 to 150 K.W., D C. 220 Volts direct to engine—Want high-class outfit.

**WM. SEYMOUR**
5117 Kenwood Ave., Chicago

# MOTORS

***ready for immediate shipment***

2—75-hp., 3-phase, 60-cycle, 220-volt, 875-r.p.m. Westinghouse C. W. Motors.

1—35-hp. Westinghouse frame 131, 250 to 1000-r.p.m., D.C., compound wound, reversing planer motor complete with control.

1—5-hp., 250-volt, D.C., cross-rail motor complete for use with above planer motor. These motors are brand new and can be shipped immediately

**THE CROWDER, JR., CO.**
First National Bank Bldg., Easton, Pa.

***IMMEDIATE DELIVERY***

**25-Cycle, 440-Volts, 3-Phase**

# MOTORS

| Qu. | Hp. | R.p.m. | Type | Make |
|---|---|---|---|---|
| 1 | 150 | 480 | Slip Ring | General Elec. |
| 1 | 75 | 720 | Squirrel Cage | General Elec. |
| 1 | 75 | 1440 | Squirrel Cage | Westinghouse |
| 3 | 50 | 720 | Squirrel Cage | Allis-Chalmers |
| 2 | 20 | 1440 | Squirrel Cage | Allis-Chalmers |
| 2 | 15 | 720 | Squirrel Cage | Allis-Chalmers |
| 2 | 10 | 720 | Squirrel Cage | Allis-Chalmers |
| 1 | 7½ | 720 | Squirrel Cage | Allis-Chalmers |
| 4 | 5 | 720 | Squirrel Cage | Allis-Chalmers |

**1—15 Kw., 120 Volt, 1100 R.P.M. D.C. Generator**

**W. G. SWART**
808 Sellwood Building, Duluth, Minn.

FOR SALE

## 125 kva. Engine Generator Set

*(First Class Used)*

**Now in transit to our warehouse.**

1—125 KVA. Burke A.C. Generator No. 50707, 2300 volts, 60 cycle, 3 phase, 32 amp, per terminal. With 7KW. Burke D. C. Exciter No. 50533, type AM. Direct connected to 14-in. x 18-in. McIntosh & Seymour, side crank, automatic 4-valve engine No. 1521. Speed 225 R.P.M.

Floor space 13-ft. 0-in. x 16-ft. 0-in.
This machine used slightly about 3 years.
Condition guaranteed.
PRICE $4250.00 f. o. b. cars, Louisville, Miss.
Subject to prior disposition.

**RAILWAY & MINE SUPPLY CO.**

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FOR SALE

One used 40-kw. Generating Unit. One 10 x 11 simple center crank Single Valve Chuse Engine, d.c. to and including 1—40-kw., 110-volt, Western Electric Company D.C. Generator, speed 290 r.p.m., ***complete with standard switchboard. Engine being thoroughly overhauled. Generator in elegant condition. Can ship in three weeks.***

**CHUSE ENGINE & MFG. CO.**
Mattoon, Ill.

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DIRECT CONNECTED

## GENERATING SET

500 Kva. General Electric Revolving Field, 3-phase, 25-cycle, 480 volts, 107 R.P.M., direct connected to Hardie Tynes Cross Compound Corliss Engine 22 x 44 x 44, complete with switchboard, instruments and connections, with 45-Kw. Exciter, belted to main shaft, 125 volts, Fort Wayne. This set good as new, housed and operated less than four months. May be inspected at plant of Coosa Portland Cement Co., Ragland, Alabama.

*For details and price apply*

**J. F. DONAHOO CO.**
Birmingham, Alabama
*Also other smaller plants*

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FOR SALE

1—250 kva. Westinghouse

## GEARED TURBINE

2300-V, 3-Ph., 60-Cy. With Condenser. New Machine, have no use for same.

**A. C. BURMEISTER**
Redwood Falls, Minn.

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FOR SALE—4 General Electric, Type H

## TRANSFORMERS

60-cycle, single phase, 11,000/2300-volt, 30-kva. These Transformers are in A-1 condition and have never had their full load on them. Immediate delivery.

**Central Texas Power & Transmission Co.**
**Att. H. Gleason**
Hico, Texas

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FOR SALE

## ELECTRIC POWER PLANT

now on skids at Redwine, Kentucky; can ship quick. Recently overhauled and is in perfect working order. Price $6750, f.o.b. cars Redwine, Ky., sight draft and B/L attached. Can be inspected any time.

## 1—GENERAL ELECTRIC CURTIS TURBO UNIT

consisting of:

**Generator:** 1—750-kw. General Electric vertical, 3-phase, 60-cycle, 2300 or 440 volts, 1800 r.p.m.

**Turbine:** 750-kw. condensing, (550 kw.) non-condensing Curtis vertical, 1800 r.p.m., 150 lb. steam pressure at throttle, 28-in. vacuum.

*Above complete with all piping equipment.*

*No condenser equipment.*

**LENOX SAW MILL CO.**
**Pittsburgh, Pa.**

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FOR SALE

## 1000 K.W. Unit

25-cycle 2-phase 240 volts
8 x 10

## Brownell Engine

1000 K.W

## Turbo Generator

25 cycle 2 phase 240 volts

## 250 K.W. Unit

2 phase 30 cycle 200 K.W.

## Rotary Converter

2 phase 25 cycle 178 volt to 250 volt D.C.

50 K.W.

## Motor Generator Set

75 H.P. 2 phase, 25 cycle, 200 volt motor—125 Volt Generator.

100 K.W.

## Motor Generator Exciter Set

***Delivery about Feb. 1919***

**THE B. F. GOODRICH CO.**
Dept. 37 Akron, Ohio

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## WESTINGHOUSE

**MOTORS—METERS**
**TRANSFORMERS**

We have one of the largest stocks in New York State. Get the correct price for the apparatus you need from the nearest Westinghouse Representative, then wire us to make shipment. Our prices are the same.

We have the following 3-phase, 220-volts, 60-cycle motors in stock:

| Horsepower | Speed | Quantity |
|---|---|---|
| 5 | 1140 | 0 |
| 7½ | 1740 | 8 |
| 7½ | 1140 | 12 |
| 10 | 1740 | 6 |
| 10 | 1150 | 9 |
| 10 | 860 | 4 |
| 15 | 860 | 4 |
| 15 | 1740 | 3 |
| 15 | 1155 | 9 |
| 20 | 860 | 4 |
| 20 | 1160 | 4 |
| 25 | 1755 | 0 |
| 25 | 1160 | 2 |
| 25 | 860 | 9 |
| 30 | 1140 | 6 |
| 30 | 860 | 3 |
| 40 | 1755 | 0 |
| 40 | 1170 | 4 |
| 40 | 870 | 3 |
| 50 | 1170 | 3 |

*In addition to the above we have a large stock of single-phase two-phase and direct-current motors—also meters and transformers. Let us send you our monthly stock list.*

**Rochester Electrical Supply Company**
240 Saint Paul St.
Rochester New York

## 25-CYCLE MOTORS.

| Quan. | Hp. | R.p.m. | Type | Vert. or Horiz. |
|---|---|---|---|---|
| 7 | 1 | 1500 | Squirrel Cage | Horiz. |
| 10 | 1 | 750 | Squirrel Cage | Horiz. |
| 1 | 2 | 1500 | Squirrel Cage | Horiz. |
| 2 | 2 | 1500 | Squirrel Cage | Vert. |
| 2 | 7½ | 1500 | Squirrel Cage | Horiz. |
| 12 | 7½ | 750 | Squirrel Cage | Horiz. |
| 16 | 10 | 750 | Squirrel Cage | Horiz. |
| 1 | 10 | 500 | Squirrel Cage | Horiz. |
| 6 | 15 | 750 | Squirrel Cage | Horiz. |
| 1 | 20 | 500 | Squirrel Cage | Horiz. |
| 4 | 20 | 750 | Squirrel Cage | Horiz. |
| 7 | 25 | 750 | Squirrel Cage | Horiz. |
| 1 | 100 | 500 | Squirrel Cage | Horiz. |
| 1 | 200 | 187 | Squirrel Cage | Horiz. |

## 25-CYCLE GENERATORS

1—160-kw. (215-hp. Syn. motor) 750-r.p.m., complete with exciter (2 bearings).
1—240-kw., 187½-r.p.m., engine type Generator.
1—240-kw., 214-r.p.m., engine type Generator, complete with an 18 x 29 x 18, 125-lb. steam pressure Ames engine.
1—360-kw. (480-hp. Syn. motor), 500-r.p.m., complete with exciter (2 bearings).
1—440-kw. (590-hp. Syn. motor), 250-r.p.m., complete with exciter (3 bearings).

*The above equipment is new and used and of the General Electric make, with exception of a few items and represents a purchase recently made by us.*

## 25-CYCLE TRANSFORMERS

3—75-kva., 22000/11000‡440-220-volt, single phase Pittsburgh Transformers (Disc type).

## D. C. GENERATORS

1—35-kw., 125-volt, 725-r.p.m. Westinghouse Generators, complete with base, pulley and rheostat.
1—45-kw., 125-volt, 1200-r.p.m. Westinghouse Generator, complete with base pulley 7 rheostat.

***Ask for our list of 60 cycle motors.***

**A. J. DOTTERWEICH CO., Inc.**
285 Washington Street, Buffalo, N. Y.

# A.C. STEAM ENGINE GENERATOR SETS

1—3-phase, 60-cycle, 2200-volt, 200-kw. General Electric Generator, direct connected to McIntosh & Seymour Steam Engine.

1—3-phase, 60-cycle, 2200-volt, 133-kw. G. E. Generator, direct connected to Ide & Sons Steam Engine.

1—3-phase, 25-cycle, 5600-volt, General Electric Generator, 200 kw., direct connected to Harrisburg steam engine. This set can be reconnected for 2200 volts.

**Duquesne Electric & Mfg. Co.**
Pittsburgh, Pa., or
230 So. La Salle St., Chicago, Ill.

FOR SALE

## ELECTRIC MOTORS

3-phase, 60-cycle, low voltage.

| | |
|---|---|
| 100-hp., 1800 r.p.m. | 50-hp., 900 r.p.m. |
| 100-hp., 1200 r.p.m. | 40-hp., 1200 r.p.m. |
| 75-hp., 1200 r.p.m. | 40-hp., 900 r.p.m. |

**NATIONAL ELECTRICAL EXCHANGE**
Aurora, Ill.

FOR SALE

## McEWEN ENGINE

1—McEwen Engine, No. 1282, 189 hp., 18-in. stroke, 16-in. bore, 220 r.p.m.

## COMPRESSORS

1—Sullivan Compressor, No. 387 W. B. 2—24 x 26—16½ x 30, 2-Stage.

1—Ingersoll-Rand Compressor, Uo. 11,242, Class A, steam, 24 x 30, air, 26¼ x 30.

## GENERATOR

1—Morgan-Gardner Generator, 100 kw., 250 volts, 400 amperes, 575 r.p.m., complete with generator panel, slide rails, no pulley.

**KELLER COAL COMPANY**
Old Colony Bldg., Chicago, Ill.

FOR SALE

***Immediate Delivery from Scranton, Pa.***

Seven brand new General Electric Type CO 1804, 7½-hp., 230-volt, direct current, 1200 r.p.m. series wound

## CRANE MOTORS

complete with R-122-A reversible drum controllers and cast grid resistance.

**Price, $300 each.**

**Engineering Development Company**
Connell Bldg., Scranton, Pa.

**French firm several years' experience in Electrical Trade, having offices in Paris and Havre and Agents throughout France**

***wishes to represent***

**AMERICAN MANUFACTURERS of DYNAMO, MOTORS and TRANSFORMERS**

**Write: MATERIEL ELECTRIQUE**
**ALEX LEFEBVRE**
Sainte-Adresse Havre, France

***Prompt Delivery***

**Vertical Alternators and Exciter**

2—650-kv.-a., 150-r.p.m., 48-pole, 2400-volt, 156 amperes, 60-cycle, 3-phase, vertical type Generators complete with buses, shafts, steady bearings and field rheostats.
1—50-kw., 450-r.p.m., 125-volt, vertical type exciter complete with base, shaft, thrust bearing above and steady bearing below, and field rheostat.
For details and very attractive prices, write us.
**The F. Bissell Company**, Toledo, Ohio, U. S. A.

# ROSS POWER EQUIPMENT CO.

**Indianapolis, Ind.**

## STEAM TURBINES

1—25 Kw. 125 V. G. E. Turbo Exciter Non-Cond.
2—75 Kw. 125 V. Dir. Cur. G. E. Non-Cond.
1—75 Kw. 250 V. Dir. Cur. G. E. NEW. Non-Cond.
1—187 Kva. 2400 V. 60 Cy. 3 Ph. Westg. N. C.
1—125 Kva. 2300 V. 60 Cy. 3 Ph. G. E. N. C.
1—375 Kva. 2300 V. 60 Cy. 3 Ph. Westge. Cond.
1—375 Kva. 600 V. 60 Cy. 3 Ph. Westge. Cond.
1—1250 Kva. 2300 V. 60 Cy. 3 Ph. Westge. Cond.
1—2000 Kw. 2400 V. 60 Cy. 2 Ph. Westge. Cond.
1—9375 Kva. 2300 V. 60 Cy. 3 Ph. Westge. Cond.
1— 150 Kw. 125-250 V. 3 wire Turbo N. Cond.

## ENGINE SETS, ETC.

1—125 Kva. 2300 V. 60 Cy. 3 Ph. Westge. C. C.
3—500 Kw. 2300 V. 60 Cy. 3 Ph. C. C.
2—200 Kw. 250 V. D.C.
1—300 Kw. 240 V. Dir. Cur. C. C.
1—500 HP. 180 lb. **Heine Type Boiler**
1—500 HP. NEW 200 lb. **Water Tube Boiler**
2—1500ft. Duplex Steam Driven **Air Compressors**
6—500 H.P. 150 lb. **Stirling Boilers** with 3-800 Kw. 25 Cy. G. E. Engine Sets, **COMPLETE PLANT**
1—No. 12 Gates Rock Crusher

***Send for our large January Bulletin***

***Rebuilt and Used Machinery***

FOR SALE

## CORLISS ENGINE

500 hp. Cross Compound Murray Rolling Mill, Corliss Engine, belt drive.

## BOILERS

66 x 16, 125-lb. Tubular Boiler.
150 hp. Erie City Horizontal Water Tube Boiler, 150 lb.
100 hp. Erie City Horizontal Water Tube Boiler, 125 lb.
54 x 14 Kewanee Fire Box Heating Boiler.

## FEED WATER HEATERS

300 hp. Angel Feed Water Heater.
500 hp. IXL Open Feed Water Heater—NEW.

**Triplex Geared Pumps, Steam Pumps, Engines and Boilers of other descriptions.**

**POWER PLANT MACHINERY CO.**
343 S. Dearborn St., Chicago

**New Westinghouse**

# MOTORS

**For Heavy Duty**

***Immediate Delivery***

60 cy., 3 ph., 2200 v.
1500 hp., 505 r.p.m.
1400 hp., 234 r.p.m.
700 hp., 502 r.p.m.
600 hp., 440 r.p.m.
500-kw. Rotary Converter, 2200 v., 3 ph., 60 cy., A. C. to 250 v. D. C., with transformers.

**Address Dept. "E,"**

**WRIGHT WIRE CO.**
Worcester, Mass.

## AIR COMPRESSOR

One Chicago Pneumatic air compressor, 10 x 12, complete with tank, gauge and accessories. Used very little. With or without 50-hp. Electric Motor. Bargain.

**NATHAN KLEIN & CO.**
208 Centre Street, New York City

# NEW
## POWER HOUSE
# EQUIPMENT
***Immediate Delivery***

4—512-hp. B. & W. Boilers, with Foster Superheaters and Riley Stokers.

Also 2 C. H. Wheeler Mfg. Co. Jet Condensers, suitable for 6000-kw. turbine capacity.

1—Jewel Filter of 500 gal. per min. capacity.

4—Richardson Automatic Coal Scales, 100 lb. cap. each.

**Address Dept. "E"**

**WRIGHT WIRE CO.**
Worcester, Mass.

---

FOR SALE
One complete **Stromberg-Carlson**
## TELEPHONE SYSTEM
20 'phones
The balance of this equipment has been sold.

FS314—Elec. World
657 Leader-News Bldg., Cleveland, Ohio

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FOR SALE
## Wall, Desk and Intercommunicating Telephones

13 W. E. Wall Type, with Cabinets.
30 W. E. Desk sets complete, with ringing boxes.
29 W. E. Wall phones.
100 Deveau Wall Phones.
39 Deveau Inter-communicating phones, consisting of
21 units of 24 stations.
12 units of 12 stations.
6 Units of 6 stations
1 W. E. Switchboard of 130 positions.
1 Holtzer-Cabot, complete charging outfit.
8-Panel Switchboard.
24-cell Storage Battery.

**Mount Sinai Hospital**
100th St. and 5th Ave., New York City

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I offer for sale the following:

2—400 hp. Stirling **Boilers**, with Murphy **Stokers.**
2—300 hp. Stirling **Boilers**, with Murphy **Stokers.**
2—250 hp. Stirling **Boilers**, with Murphy **Stokers.**
2—250 hp. Stirling **Boilers**, with Detroit **Stokers.**
2—260 hp. Vogt **Boilers**, Hand Fired. All Hartford 150-lb. Working Pressure.
6—150 hp. Triple Riveted, Butt Strapped. 125-lb. Horizontal Return Tubulars.
**1—300 kw., 440-2300 Volt, 3 Ph, 60 Cy. McIntosh & Seymour Unit.**
**1—20 kw., 250 Volt, D.C., Unit.**
**1—25 kw., 125 Volt, D.C., Unit.**

**J. H. COCHRAN**
Keller Bldg., Louisville, Ky.

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## ELECTRIC MOTORS

1—3 hp., 3 phase, 60 cycle, 110/220 volts.
1—15 hp., 3 phase, 60 cycle, 440 volts.
1—20-hp., 3 phase, 60 cycle, 440 volts.
1—25 hp., 3 phase, 60 cycle, 440 volts.
1—75 hp., 3 phase, 60 cycle, 440 volts.

## MISCELLANEOUS

2—G. E. Transformers, Type H, Form R, top, 60 cycle, cap. 75 kw., 6600/6270,—2200.

1—S. Morgan Smith, 14 in. Water Wheel, complete with case and draft tubes (no governor).

**GEO. J. LOW, Trustee**
101 Park Avenue, New York
Phone, Murray Hill, 4592

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## ELECTRIC HOIST

1—Lambert Electric Hoist, 25-hp., single drum, geared to 25-hp. Westinghouse motor, 220 volt. Arranged with drum control. First-class condition.

**A. G. SCHOONMAKER & SONS, Inc.**
25 Church St., New York City

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We offer for immediate delivery, subject to prior sale, the following material in original packages:

129 lb. of No. 12 D.C.C. Magnet Wire.
479 lb. of No. 14 D.C.C. Magnet Wire.
188 lb. of No. 26 D.C.C. Magnet Wire.
200 lb. of No. 24 D.C.C. Magnet Wire.
313 lb. of No. 28 D.C.C. Magnet Wire.
1909 lb. of No. 34 Single Silk covered Magnet Wire.
2400 ft. of No. 12 Solid Rubber covered single braid Line Wire.
1100 ft. of No. 18 Flexible High Frequency Cable.
16 Strands No. 18 B. & S. 11/32 Rubber Insulation.
1 Single covered Black Braid.

FS195—Electrical World
10th Ave. at 36th St., New York City

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## WATER TUBE BOILERS

3—500-hp. Stirling, 175-lb. pressure. Extra heavy flanged steam header. Individual stacks.
4—250-hp. Stirling, 175-lb. pressure. Extra heavy flanged steam header. Individual stacks.
2—400-hp. Babcock & Wilcox, 160-lb. pressure.

*Innumerable others—all sizes.*

**POWER EQUIPMENT CO., ENGRS.**
1218 Chestnut St., Philadelphia, Pa.

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### Located at Pensacola, Fla.

1—10-ton Whitcomb standard gauge gasoline **locomotive.**

### Located at Powellton, W. Va.

1—**Norwalk Shop** No. 691, **Air Compressor,** with 14½ in. double acting intake **Air Cylinder,** 11½ in. single acting **Compressing Cylinder,** 20 in. x 24 in. **Steam Cylinder,** 24 in. stroke, compressor capacity 300 cu. ft. free air per minute to 850 lb., 100 r.p.m., weight 29,000 lb.
1—10-ton **Air Locomotive,** 8 x 14 in. cylinder, 36 in. gauge, 2 main **Tanks,** one for reduced air 24 in. drivers.

Above two units will be sold together at a very attractive price.

**Compressor** designed for charging Locomotive described.

### Located at Stanaford, W. Va.

1—150 kw., 500 volt, 500 r.p.m., **Generator,** with belt pulley, 28 in. x 22 in. face. Will be sold without engine.
1—5 hp., 1300 r.p.m., 500 volt D.C. **Motor,** complete with pulley base and starter.

### Located at Mayville, Wis.

1—**Locomotive Type Boiler,** firebox 58 in. x 42 in., 176 1¼ in. x 7 ft. 8 in. flues, ½ in. sheet double-riveted **Lap Joints,** ¾ in. stay bolts.

### Located at Ironwood, Mich.

1—6 x 8 Hoist, 24 x 20 drum, **Lake Snore Engine Works** make.

**J. P. McGUIGAN, *Purch. Agt.***
1101 1st Nat. Bank Bldg., Milwaukee, Wis.

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### MOTORS
1—75-hp., A.C., 220 or 440-volt, 60-cycle, 3phase, New.
2—100-hp., A.C., 2200-volt, 60-cycle, 3-phase, Slip Ring, Crocker-Wheeler with starters.

### GENERATORS
1—100-kw., D.C., 110-125-volt, 250-r.p.m., 2 bearings, rheostat, half coupling.
1—150-kw., D.C., 250- volt, 200-r.p.m.

### BELTED ENGINES
1—16½ x 30-in. Buckeye Engine.
1—20 x 48-in. Lane-Bodley Corliss.
1—11 x 21-in. Buckeye Engine.
1—24 x 24-in. Ball.

### GAS ENGINES
1—125-kw., D.C., 250-volt, generator connected to four cylinder gas engine.

### WATER TUBE BOILERS
1—250-hp. Heine.
1—400-hp. B. & W.

### COMPRESSORS
1—18 x 18-in. Duplex Belt Driven Laidlaw-Dunn-Gordon Air Compressor.
2—18 x 12 x 12-in. Duplex Laidlaw-Dunn-Gordon, two stage, belt driven.

### DOUBLE LEATHER BELTING
1—Piece, 18 in. wide, 45 ft. long.
1—Piece, 20 in. wide, 45 ft. long.
1—Endless Belt, 30 in. wide, 103 ft. long.

**CASTLE & WILSON**
403 Wood St., Pittsburgh, Pa.

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## CORLISS ENGINES

28 x 48 Wetherill
16 x 36 Wetherill
14 x 36 Wetherill
22 x 42 Frick
18 x 42 Hamilton
10 x 20 Hamilton

*Innumerable others—all sizes*

**POWER EQUIPMENT CO., ENGRS.**
1218 Chestnut St., Philadelphia, Pa.

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# ELECTRICAL REPAIR SERVICE
## DENTON ENGINEERING & CONSTRUCTION CO. Kansas City, Mo.
**317-319 E. 17th Street**
***A SHOP EQUIPPED TO REPAIR ANY KIND OF ELECTRICAL MACHINERY***

FOR SALE

## Electric Light and Ice Plant in prosperous growing town in Kansas.

Plant new and modern. 2300 volts, 60 cycles, 3-phase, Corliss engines; all in excellent condition. 725 electric connections. Total sales last 12 months $46,000, of which over $27,600 was electric current, $12,000 was ice, and the balance merchandise and wiring. Long franchise and city lighting and pumping contract. Good rates. Business growing. Public sentiment excellent Price $90,000, half cash. Will deal only with principals.

BO209—Elec. World
1570 Old Colony Bldg., Chicago, Ill.

## Two Good Sets

75-kw. Westinghouse, 2200-v., 60-cy., A. C. Generator, with exciter, directly connected to Chuse 13½ x 13 Standard 4-valve engine.

50-kw. Westinghouse, 2200-v., 60-cy., A. C. Generator, with exciter, directly connected to Chuse 11 x 12 Standard 4-valve engine.

*These sets both in excellent operating condition and for immediate delivery.*

**McBee Engine & Implement Co.**
Box 781, Memphis, Tenn.

FOR SALE

## ENGINE AND TURBO GENERATORS

1—750-hp. Filer & Stowell heavy duty engine, 16-in. and 36-in. x 48-in. cross compound, condensing engine, with condenser, etc.

1—375-kva., Westinghouse A.C. turbo generator, 2300-v., 3-ph., 60-cy.

1—250-kva., Westinghouse A.C. turbo generator, 2300-v., 3-ph., 60-cy.

Condensing unit for above.

**GODDARD BROTHERS, *Agents***
50 South Main Street,
Providence, R. I.

## Direct Current, Direct Connected Units

**110—125 Volts**

**With High Grade Engines**

| | |
|---|---|
| 1—500-kw. | 2—300-kw. |
| 1— 50-kw. | 1— 40-kw. |
| 1—100-kw. | 1—62½-kw. |
| 1— 25-kw. | |

*Alos innumerable others, including belted type*

**POWER EQUIPMENT CO., ENGRS.**
1218 Chestnut St., Philadelphia, Pa.

## 125-HP. CROCKER-WHEELER D. C. MOTOR

230 v., 440 amp., 500 r.p.m., series wound. Practically new, with automatic starter, Electric Control & Mfg. Co. form A. S. B. K. Located in Brooklyn.

**FRED S. CARVER**
8 W. 40th St., New York City

FOR SALE

## TURBO ALTERNATOR

1—625-kw. mixed pressure Turbo Alternator, 3 phase, 60 cycle, 2300 volts with condenser switchboard and all equipment for making a complete installation.

***Unit Ready for Shipment Immediately.***

**HENRY P. THOMPSON**
Mercantile Library Bldg., Cincinnati, Ohio

FOR SALE

***Immediate Shipment***

1—Westinghouse-Parsons

## TURBO GENERATOR UNIT

turbine, 7500 kw., 1200 r.p.m., 200 lb. pressure. Generator rated 9375 kva. at 80% power factor, 2300 volts, 3-phase, 60 cycles, complete with Westinghouse LeBlanc No. 18 condenser, with steam turbine driven air and circulating pump.

**The Northern Ohio Traction & Light Company**
Akron, Ohio

## 2—Westinghouse Constant Potential A. C. Generators

Serial Nos. 96906 and 96907, 300 r.p.m., 2-phase, 60-cycle, 2200 volts, complete with field resistances and pulleys.

## 2—Westinghouse D.C. Generators

550 volts, 455 amperes, 450 r.p.m., complete with resistances and pulleys.

*This equipment is in first-class operating condition.*

**UTICA GAS & ELECTRIC COMPANY**
Utica, New York

FOR SALE

## GENERATING UNIT

**One 500 Kw. Unit, consisting of**

1—60-cy., 2-ph., 220-v., 144 r.p.m. Westinghouse Generator, direct connected to

1—21 & 38 x 30 Harrisburg Cross Compound Engine, complete with Worthington Surface Condenser.

***Immediate Delivery***

**THE B. F. GOODRICH CO.**
Dept. 37, Akron, Ohio

FOR SALE

2—13 in. x 14 in. **Robb Armstrong** 100 hp.

## Horizontal Engines

coupled direct to 75 k. w. 110 V. D. C. Canadian Westinghouse Generators, complete with switchboards.

1—9 in. x 10 in. Ditto 25 kw., 110 V., (50 hp.).

These machines are in the pink of condition. The plant having closed down is the reason for selling.

***Prices and particulars from***

**WM. C. CAPLEN**
Supt. Pemberton Bldg., Victoria, B. C.

## Direct Current Units

2—500-kw. General Electric Generators, direct connected to Cross Compound Corliss Engines, 220-250 volt. Can be used 3-wire system, 115 or 250 volt.

4—300-kw. General Electric Generators, direct connected to Cross Compound Corliss Engines, 220-250 volt. Can be used 3-wire system, 115 or 250 volt.

*Innumerable others in stock.*

**POWER EQUIPMENT CO., ENGRS.**
1218 Chestnut St., Philadelphia, Pa.

## *AT A SACRIFICE*

2—235-hp. Worthington Watertube

## BOILERS

with Sturtevant Turbine Driven Blowers and Stacks.

*Located in New York.*
*Immediate Shipment*

**OPHULS, HILL & McCREERY, Inc.**
***Consulting Engineers***
112 West 42nd St., New York, N. Y.

***To My Friends and the Public!***

After twenty years doing business in Cincinnati, wish to announce having opened an office in Chicago where we will endeavor to serve our customers with

**Second Hand Electric and Steam Machinery**

Soliciting your correspondence, we are sincerely yours,

JOHN A. STEWART.
**JOHN A. STEWART ELECTRIC CO.**
1034-208 So. La Salle St., Chicago, Ill.

## STACK

Steel stack, diameter 8 feet, height 125 feet, thickness ¼ inch at bottom to 5/16 inch at top, with ladder at side of stack. Will be sold f. o. b. cars Chicago.

**ROSE ELECTRIC COMPANY.**
6401 S. State St., Chicago, Ill.

FOR SALE

550-v., 3-phase, 60-cycle, G.E.K.

## MOTORS

4—35 hp., 900 r.p.m., at $450 each.
2—20 hp., 900 r.p.m., at 350 each.
1—15 hp., 1200 r.p.m., at 285 each.
4—10 hp., 900 r.p.m., at 285 each.
7— 5 hp., 900 r.p.m., at 150 each.

**GLEASON & SMITH CO.**
241 Franklin St., Boston, Mass.

## QUALITY MACHINERY

**never causes failures or regrets**

We buy and sell only the BEST
What are your requirements?

**GEARE & CO.**, *ENGINEERS*
Old Colony Bldg., Chicago

WANTED

## DIRECT CONNECTED LIGHTING UNIT

15 kilowatts, 110 volts, Vertical or Horizontal Engine.

**THE MICHIGAN PIPE COMPANY**
Bay City, Mich.

FOR SALE

## PUMP

Byron-Jackson two stage Centrifugal Pump. 8 in. suction, 7 in. discharge, connected to a 100 hp., 900 r.p.m., 3 phase, 2200 volt Fairbanks motor. ***Good condition. Immediate shipment.***

**PIONEER ELECTRIC COMPANY**
137 East 5th St., St. Paul, Minn.

FOR SALE

## TRANSFORMERS

Three 150 kva., single phase, 60-cycle, oil insulated, self cooled, indoor type, 6600 to 2305 volts, Westinghouse.

**DES MOINES ELECTRIC CO.**
Des Moines, Iowa

FOR SALE

3—Practically new G. E.

## TRANSFORMERS

Type H, 25 cycle, 75 kva., 11000/9900 Primary, 460/2300 Secondary volts, for immediate shipment.

**BERKSHIRE ELECTRIC CO.**
77-79 Eagle St., Pittsfield, Mass.

## TURBO GENERATORS ✓

3—1250-kw., 60-cy., 3-ph., (1—2300-v., 2—11,000-v.) Westinghouse Parsons.

## ENGINE

1—500-hp. Cross Compound Corliss Bass, used 3 months.

## BOILER

1—Scotch Marine, 290 tubes, 2¾ in. x 8 ft. 2 Furnaces 50 in. x 8 ft. 3 in.

**J. ALEX. MAYERS**
Engineer and Contractor
55 William St., New York City

## WHY NOT

Send us your

## ELECTRICAL MOTOR REPAIRS?

We are equipped to handle them satisfactorily. We also carry a large stock of New and Used Motors for immediate shipment.

*Give us a trial and be convinced.*

**OLSON-BOETTGER ELECTRIC MFG. CO.**
St. Paul, Minn.

FOR SALE

## 10,000-volt TRANSFORMERS

3—50-Kw., 10,000-220-110-Volt Type H, form A 60-Cycle General Electric Transformers, Oil Cooled.
Ready for immediate delivery.
Price f.o.b. Youngstown, Ohio, $200 each.

**MILLER SMYTHE ELECTRIC CO.**
Youngstown, Ohio

FOR SALE

One 150-Kw. General Electric D. C.

## TURBINE AND GENERATOR

DIRECT CONNECTED

This equipment is in first-class condition.

**THE GARLOCK PACKING CO.**
Palmyra, N. Y.

## ENGINE-GENERATOR SET

1—Tandem Compound Horizontal Engine, 14 and 20 x 24, 125 lb. steam, direct connected to 200 kw., G. E., Form L, Type MP, compound wound generator, 250-275 volts, D.C., 870 amp., with field rheostat. First-class.

## SYNCHRONOUS MOTOR

1—225 hp. or 150 kw. Ft. Wayne Motor or generator, Type TRB, Form B, 3 phase, 60 cycle, 480 volts, 180 amp., 900 r.p.m. With exciter, switchboard and instruments. Practically new.

## SURFACE CONDENSER

1—3000 sq.ft. Alberger, length overall 17 ft., diam. 4 ft., contains 1106 ¾-in. tubes 14 ft. 4⅛ in. long. Without pump. First-class.

**ZELNICKER in ST. LOUIS**

5000 HP. Approx. Jones Patented Under Feed

## Stokers

A1 physical and mechanical condition—Discontinued from service only on account of increased Stoker capacity per boiler required.

**PAUL STEWART & CO.**
**Electrical & Steam Machinery**
**First National Bank Bldg., Cincinnati, O.**

## TRANSFORMERS

for Light and Power service.
Careful attention given special Aparatus.

**VINDEX ELECTRIC MFG. CO.**
Aurora, Ill.

FOR SALE

## MOTORS

15 hp., 220 V., 860 r.p.m. new Crocker-Wheeler—one 3-ph., two 2-ph., $425 each, complete.

***Immediate Delivery.***

**BALDWIN & COPELAND**
16 Yale Ave., Jersey City, N. J.

***Immediate Delivery***

1—75 hp. New Fairbanks-Morse, 3-phase, 60-cycle, 2300 volt, 900 r.p.m., Squirrel Cage Induction

## MOTOR

complete with rails pulley and compensator.

**THE MOYERS-BENNETT COMPANY**
Schmulbach Bldg., Wheeling, W. Va.

FOR SALE

1—150-hp. D. C. Compound Wound

## CROCKER-WHEELER MOTORS

230 volts, 540 amps., 450 r.p.m., size 150-D, Serial No. 93, Code No. 29851, 6 poles, 2 bearings, pulley 18 in. diameter, 31 in. face; also complete with Cutler-Hammer, Starter and Rails.

**AMERICAN INSULATED WIRE & CABLE CO.**
21st, Sangamon and Morgan Sts., Chicago, Ill.
Phone Canal 1854

WANTED TO BUY

## ENGINE GENERATOR SET

New or good used, 100 to 175-kva., 220-v., 2-ph., 60-cy., direct connected.

**IMMEDIATE SHIPMENT**

*Wire our expense, description and price.*

WOOD & LANE CO.
915 Olive St., St. Louis, Mo.

***There is a Searchlight Section in each of the following papers:***

[1] **American Machinist**

[2] **Coal Age**

[3] **Electrical World**

[4] **Electrical Merchandising**

[5] **Electric Railway Journal**

[6] **Engineering and Mining Journal**

[7] **Engineering News-Record**

[8] **Chemical and Metallurgical Engineering**

[9] **Power**

**Each of these 9 papers is the leading periodical of the industry it serves.**

**Searchlight advertisements will get you in touch with the important men of these important industries.**

## LOCKERS

Will buy 100 to 150 metal lockers in good condition. Delivery at New York. Give specifications and prices.

McGRAW-HILL CO., Inc.
10th Ave. at 36th St., New York, N. Y.

FIRST—Get Bulletin 250—or, Wire
**ZELNICKER IN ST. LOUIS**
Before Buying or Selling
**Steam and Electric**
**Power Plant Equipment**
Machinery—Tanks—Pipe—etc.
*What have you for sale?*

## CRANE MOTORS

2—75 hp., G. E. series, hoist or crane motors, with controllers. Immediate delivery, big bargain.

NATHAN KLEIN & CO.
208 Centre St., N. Y. City

### FOR SALE

**Electric Light Plant**

For sale in 2 small towns having 4 sawmills. Cheap power. Business growing. Fine place for practical electrician, $4500 will handle proposition. James R. Wheeler, owner, Winchester, Oregon, Douglass County.

**Galvanized Conduit Lock Nuts**

For sale 4,000 1¼". Material in first-class condition. What is your best offer? Address Line Material Company, South Milwaukee, Wis.

**Electric Light Plant For Sale**

in Central Illinois, plant in good condition, and on paying basis, owner too old to continue in the business, desires to sell. FS-301, Elec. World, Chicago.

**Electric Lighting Business**

For sale by owner serving 2500 inhabitants, North Texas. Plant and line system good condition, 4 years old. Current last year $8000. Price $17,500, half cash. Owner has larger business elsewhere. Box 491, Decatur, Texas.

### WANTED

**Wanted—Turbo-Alternator**

1000 to 1500 K.W., 2200 volts, 60 cycles, 2 phase horizontal; give details, year made, price, etc. Address W-695, Elec. World, Philadelphia.

### POSITIONS VACANT

A RECENTLY organized company wants the services of a man to take charge of the winding department. Machines will be direct current and the work will include the winding of both fields and armatures. There is prospects of extremely rapid growth and consequent advancement for the right party. Only an experienced man need apply. Write, stating salary wanted and experience to P-304, Elec. World, Leader-News Bldg., Cleveland.

## RATES:

1 inch—$4.00
4 inches— 3.90 an inch

*(The above rate applies to a 4-inch space in one issue, a 2-inch space in two issues, or a 1-inch space in four issues. The larger spaces following may be used up in a similar way.)*

8 inches—$3.80 an inch
15 inches— 3.70 an inch
27 inches— 3.60 an inch
50 inches— 3.50 an inch

Rates for larger spaces furnished on application.

**WANTED**
Underground
## CABLE SPLICERS

on 1300 Volt Cables. Good wages, location Middle West.

P210—Elec. World
1570 Old Colony Bldg., Chicago, Ill.

### POSITIONS VACANT

COIL winder wanted. Man thoroughly experienced in making coils for all classes and sizes of motors, generators, transformers, etc., to take charge of coil winding department. To competent man can offer permanent position with good salary and excellent chances for advancement. Can also use several good armature winders. The Electric Service Co., 212 Walnut St., Cincinnati, Ohio.

DESIGNING and detail draftsmen, for permanent positions with large manufacturing concern in New England. Men with electrical, steam engine, turbine or special machine experience. Apply, giving age, experience, education and salary expected by addressing, Chief Draftsman, P-244, Elec. World.

ELECTRICAL draftsman wanted, experienced, familiar with industrial plant layout. Electrical knowledge essential. Permanent position. P-319, Elec. World.

ELECTRIC and wiring man wanted; capable of estimating and installing electrical sub-station house wiring, motor installation, etc., in the coal fields. Address reply to Box No. 269, Winchester, Kentucky.

EXPERIENCED motor testers wanted. Also men with a technical education or practical men with enough electrical experience so that with a short period of training they could qualify as expert motor testers. Weston meter repair man who has had motor testing experience. Plant located within 10 miles of New York. Address P-287, Elec. World.

GENERAL engineer wanted as division superintendent by Public Utility Company. Must be thoroughly up-to-date on modern central station practice and procedure. Have thorough technical experience, initiative; ability to handle men without friction. Interview cannot be given. Give complete experience, education in detail, height, weight, nationality, photograph. P-233, Elec. World.

## WE NEED A MAN

who is familiar with switchboards, circuit breakers, and meters, who knows how to write. Technical graduate preferred.

P317—Elec. World
935 Real Estate Trust Bldg., Phila., Pa.

# Get Your Wants into the Searchlight

## ADVERTISING RATES

### Ads Set in Uniform Style

*(Solid, in one paragraph, without display.)*

**THREE CENTS A WORD,** minimum charge 50 cents an insertion, payable in advance, less 10 per cent. If one payment is made in advance for four continuous insertions—for advertisements under:

| | |
|---|---|
| Positions Wanted | Vacation Work Wanted |
| Evening Work Wanted | Tutoring |
| | Salesman Wants Connections |

**FIVE CENTS A WORD,** minimum charge $1.50 an insertion, for advertisement under:

| | |
|---|---|
| Agencies Wanted | Positions Vacant |
| Agents Wanted | Partner Wanted |
| Business Opportunities | Representations Wanted |
| Desk Room for Rent | Salesmen Wanted |
| Educational | Patents for Sale |
| Employment Agencies | Plants for Sale |
| Desk Room Wanted | Sub-Contracts Wanted |
| Foreign Business | Work Wanted |

Miscellaneous for Sale, for Rent or Want Ads.

**THIRTY CENTS A LINE,** minimum five lines, for all undisplayed advertisements set with a paragraph for each item or tabulated.

**THREE DOLLARS AND SIXTY CENTS AN INCH** for advertisements for bids (Official Proposals).

### Ads Set in Display Type

*(Individual space, within border rules.)*

Space for these advertisements is sold by the inch. Each page contains 30 inches. The rate per inch is based on the *total* number of inches to be used—that is, the number of inches the advertisement is to occupy multiplied by the number of insertions it is to receive. For instance, a 2-inch advertisement in 2 issues earns the 4-inch rate of $3.90 an inch. A 1-inch space in 4 issues, or a 4-inch space in one issue, also earn the 4-inch rate.

SCHEDULE OF RATES

| | | | |
|---|---|---|---|
| 1 to 3 in., | $4.00 an in. | 15 to 26 in., | $3.70 an in. |
| 4 to 7 in., | 3.90 an in. | 27 to 49 in., | 3.60 an in. |
| 8 to 14 in., | 3.80 an in. | 50 to 99 in., | 3.50 an in. |

Rates for larger space furnished on request.

*For quick and satisfactory results tell the reader everything that he will want to know.*

### INFORMATION

**ALLOW FIVE WORDS** for the address, if replies are to a box number in care of any of our offices. There is no extra charge for forwarding replies.

**IN REPLYING TO ADS,** do not enclose original testimonials or anything that you may want returned. State your experience and qualifications in as concise and neat a manner as possible and enclose copies of your testimonials.

**BE CAREFUL TO PUT ON ENVELOPE,** when answering any "blind," ad, the box number in the ad, the name of the paper, and also the local address of office to which reply is sent:

| | |
|---|---|
| 36th St., at 10th Ave., | New York |
| 1570 Old Colony Bldg., | Chicago |
| 657 Leader-News Bldg., | Cleveland |
| 935 Real Estate Trust Bldg., | Philadelphia |
| 501 Rialto Bldg., | San Francisco |
| 519 Newhouse Bldg., | Salt Lake City |

**WHEN ADVERTISING MACHINERY,** use your own name and address—or a local address of some kind—so that the readers can wire direct and get quick replies. We advise also that you state in your advertisement the present location of plant that is offered for sale, or point of delivery provided you are in the market for equipment.

**TO SIGN YOUR NAME** and addre to your advertisement begets the confidence of the reader and facilitates receiving replies. You can, however, obviate delay in receiving answers by signing your ad. only with initials (your own or others), care of your home, your office or a post-office box number in your city.

## POSITIONS VACANT

LINE foreman wanted for overhead distribution in Illinois. Permanent position. Give references with application. P-303, Elec. World, Chicago.

METERMEN wanted familiar with single phase meter testing on consumer's premises. Location Western New York. In reply state fully experience, age, etc. P-275, Elec. World.

METER tester, polyphase and single phase meter tester and setter and maintainer. State age, experience and salary expected. Kentucky Utilities Company, Middlesborough, Kentucky.

OPERATING engineer wanted for 2000 kw. central station, serving railway and lighting. Corliss engines and turbine. Give complete references and experience. P-1, Elec. World.

SALES and advertising manager wanted for company manufacturing electric railway and mine haulage material. This company is located middle west, has a good line, and is favorably known to the trade. Applicant must have previous experience in this business; man with technical experience preferred. Any replies will be treated strictly confidential. P-321, Elec. World, Chicago.

SUPERINTENDENT wanted for electric lighting plant in small city in Illinois, must be capable of handling steam generating part as well as the electrical part. P-302, Elec. World, Chicago.

TECHNICAL graduate wanted to assist chief engineer of industrial plant in making tests and investigating losses in connection with steam and electric plants, state age, experience, education and salary now receiving. P-281, Elec. World, Chicago.

WANTED—First-class three phase motor repair man, one who can make coils and rewind motors completely. Applf to H. E. Lowe Electric Co., Macon, Ga.

WATCH engineer wanted for 3000 kw. railway power station, familiar with Westinghouse turbines, 8-hr. watch. Give experience and references in full in first letter. Address Supt. of Power, P. O. Box 477, Norwich, Conn. U. S. E. S. Lic. No. 403.

## EMPLOYMENT AGENCIES

**Employment Service**

The undersigned provides a confidential service designed to locate openings through correspondence for men earning not less than $2,500 and up to $25,000; all lines. Not an employment agency, but a constructive, initiative service, covering individual negotiations. Established 1910. Complete privacy assured; present connections in no way jeopardized. Send name and address only for explanatory details. R. W. Bixby, M64-66 Niagara Street, Buffalo, New York.

## POSITIONS WANTED

ALL-AROUND electrical and engine man desires position in small plant. Age, 29; married. PW-285, Elec. World, Chicago.

AN opportunity to secure competent electrical engineer technically trained, age 29; 6 years' experience General Electric Test, construction work, maintenance, plant lighting, drafting, estimating, and purchasing, including 2 years in executive capacity. Minimum $3000. PW-308, Elec. World.

CAPTAIN, Signal Corps, 1½ years' service, anticipating early return to inactive duty, desires position in the electrical industry; 2 years E.E. Electric lighting and electrical engineering courses I. C. S., 6 years' experience maintenance and operation of polyphase steam-electric power systems, interior wiring, motor troubles and repair. Address Capt. L. W. Connolly, Signal Corps, Camp Meade, Md.

**POSITION WANTED**

**ELECTRICAL AND MECHANICAL ENGINEER**

of sixteen years' experience in construction, operation and maintenance of industrial plant equipment, just returned from an engagement in the Orient, desires responsible executive position with manufacturing company or connection with firm of consulting engineers. Has had broad engineering experience, is good organizer and competent to handle important work.

PW274—Electrical World
10th Ave. at 36th St., New York City

## POSITIONS WANTED

CAPTAIN of Engineers U. S. Army wants position about February 1st. College graduate; married; 10 years' experience in mechanical and electrical engineering and manufacturing of which last 4½ has been executive work. PW-230, Elec. World.

CHIEF electrician or construction foreman; 16 years, generating and sub-station. Age 33, married; references. PW-256, Elec. World.

CHIEF engineer, 10 years' experience, generating stations, air, refrigeration, pumping, machine shop. Technical graduate. Can maintain and operate your plant at least cost. Go anywhere in United States or Central America. PW-279, Elec. World, Chicago.

CHIEF electrician, 38 years; 20 years' experience construction, installation, maintenance, light and power, electric welding equipments, A. C. and D. C. storage batteries, train lighting, estimating, desires permanent position with chance for advancement. PW-292, Elec. World.

DESIGNER and draftsman wants a position with some electric motor company. Have had 12 years' experience; well recommended; now in service, about to be discharged. Address L. F. K., Box 453. Hyattesville, Md.

ELECTRICAL engineer, at present a captain Engineers, U. S. Army, wants to obtain a position as engineer with a reliable electrical firm or corporation. Has executive ability, initiative and "pep."; 5 years' experience as electrical engineer with a public service corporation; technical graduate; excellent character; age 29; single. Can furnish excellent recommendations, both civil and military. Salary expected, $3000 per year. PW-254, Elec. World.

ELECTRICAL engineer, familiar with erection and operation of power plant, industrial installations, electrical and mechanical transmission of power, cable and signal work; capable of handling men; will shortly be available for a position requiring an aggressive, competent and experienced executive. PW-260, Elec. World.

## POSITIONS WANTED

ELECTRICAL construction engineer, 12 years' experience. Power house, substation and industrial construction work. Capable of handling men with good results. Best references. PW-296, Elec. World, Phila., Pa.

ELECTRICAL and mechanical engineer, graduate 1912; now on valuation work; prefers central station position, construction or operation. PW-199, Elec. World.

ELECTRICAL engineering graduate, 27 years old, 8 years' practical experience includes testing, operation, construction, design and engineering office work. PW-309, Elec. World, Philadelphia.

ELECTRICAL engineer would like to locate with some large industrial plant as chief electrician or with central station in city of 25,000 to 50,000 as superintendent of meters and distribution. Now employed but desires a change. PW-310, Elec. World, Chicago.

ELECTRICAL engineer, technical graduate, also G. E. apprentice. 10 years' good practical experience in design development and manufacture of small electrical apparatus. PW-307, Elec. World, Chicago.

ELECTRICAL engineering graduate, American. Thoroughly experienced draftsman, inspector, construction supervisor. Moderate salary. PW-323, Elec. World.

EXECUTIVE—Scientific, efficient young organizer. Broad administrative, sales, engineering and editorial experience in electrical manufacturing field. Only responsible position with future considered. Salary, $3000. PW-239, Elec. World, Cleveland.

EXPERIENCED electric light and railway man with executive selling ability wishes position with a future. I can enlarge your business 25 to 50 per cent or raise additional capital to increase your output. Am 33, married; can go anywhere; excellent references. PW-249, Elec. World, Chicago.

EXPERIENCED central station commercial executive wants to connect with a large company in need of a first-class man. PW-322, Elec. World, Chicago.

EXPERIMENTAL engineer desires opportunity to improve own idea with reference to high tension ignition for automobile engines. PW-318, Elec. World.

EXPERIMENTAL engineer, E. E. and M. E. Recently released from war service. 6 years' experience with well known electrical manufacturing companies. Salary $200 per month. PW-305, Elec. World.

GENERAL manager of public utilities. Electric lighting, street and interurban railway, gas and water; broad administrative and technical engineering experience. Only responsible position considered. Salary $6000. PW-207, Elec. World, Philadelphia, Pa.

Keep your Eye
on the
Searchlight
and your
Advertisements in it

### In Replying to "Blind" Ads

be careful to put on envelope the key number in the ad. and also local address of office to which reply is sent.

10th Ave. at 36th St., New York.
935 Real Estate Trust Bldg., Phila.
657 Leader-News Bldg., Cleveland.
1570 Old Colony Bldg., Chicago.
519 Newhouse Bldg., Salt Lake City
501 Rialto Bldg., San Francisco.

### Important

Original letters of recommendation or other papers of value should not be enclosed to unknown correspondents—send copies.

## POSITIONS WANTED

MECHANICAL-electrical engineer experienced in power plant construction, operation and maintenance of mining machinery, and central stations. Available immediately and will go anywhere. PW-306, Elec. World, Phila.

POSITION wanted as foreman of electrical construction and maintenance of light, power, railways or industrial. 14 years' practical experience in installing operating maintenance and testing; age, 32; technical training; employed at present; salary, $175 per month. PW-231, Elec. World.

POSITION wanted as superintendent of power, steam and electrical engineer, technical education, business training. 15 years' practical experience in charge of modern light, heat and power plants. Competent to direct operation of electric railway and substations. Address Superintendent, Box 377, Cincinnati, O.

## AGENTS AND SALESMEN

**Salesman for Pumps and Motors**

For territory having Philadelphia as headquarters. Give full information as to previous experience and qualifications in first letter. AS-202, Elec. World, Philadelphia.

## AGENTS AND SALESMEN

**Stock Broker Is Open for Proposition**

That requires capital if you need funds to complete or increase your electric light or railway plant. I can raise any amount that you require. Can manage or organize company. State amount you require. Address P. J. Minck, Lee Huckins Hotel, Oklahoma City, Oklahoma.

**Salesman Wanted**

Electrical engineer, with or without selling experience. Must have personality and brains. Permanent position and a future for the right man. Write giving education, previous experience, salary desired and age. AS-289, Elec. World, Chicago.

**Salesman Wanted**

A real wire salesman. Write giving age, experience and salary. AS-290, Elec. World, Chicago.

**Export Representative, 1919**

With international commercial engineering experience in many industries wishes to connect with concern for purpose of establishing direct export relations with positive result. Traveling expenses reduced by familiarity of localities and people. Visited over 10 nationalities. Master over 10 idioms. Native from Sweden. Employed at present. American, married. Salary $3600. AS-320. Elec. World, Leader-News Bldg., Cleveland.

**MANUFACTURERS' AGENTS**

Our large selling organization can handle any manufacturers' line for the electrical industry. Fifteen years of selling experience in New York, New Jersey and Pennsylvania for the largest manufacturers of Electrical Merchandise is our best recommendation as to our ability to handle your proposition.

*If interested, address*
AS196—Electrical World
10th Ave. at 36th St., New York City

**NORWAY**

**A/S JOHANNES ANDVIG**

**A. BERGSVIK, *Managing Director***
**KRISTIANIA**

**wish to form connections with leading factories for**

**ELECTRICAL TRANSFORMERS**
**ELECTRICAL MOTORS**
**ELECTRICAL APPARATUS**
**ELECTRICAL SUPPLIES OF ALL KINDS**

**Owing to the great consumption in Norway we are able to order considerable quantities. Mr. Bergsvik intends to visit the U. S. A. during Spring 1919.**

## AGENTS AND SALESMEN

**An Electrical Comanpy at Toronto,** Canada with a selling organization and small manufacturing plant, desires to undertake the manufacture and sales of electrical devices in Canada. Inquiries invited. A. H. Fisher, 125 Ellsworth Ave., Toronto.

**Salesman Desires to Locate in the South**
Salesman and executive, technical graduate at present and for part 5 years branch office manager for one of the largest electrical machinery and supply manufacturers, desires to locate in the South, preferably Alabama. Reasons for desiring change entirely personal. Can furnish best of references and some capital if necessary. Address AS-316, Elec. World.

**Sales Manager Desires Change.**
Now employed 15,000 consumer central station. Plants loaded, no further opportunity to make showing. With present employer 5½ years. Can furnish the best of references. 32 years of age; married; live wire, enthusiastic, original ideas, experienced in handling public and employees. Always in electrical business, practical experience, some technical knowledge. Wants opportunity to make showing with reliable manufacturer or central station. AS-311, Elec. World, Rialto Bldg., San Francisco.

**Salesman Wanted**
For selling carbon brushes. Excellent opportunity offered ambitious man to develop sales organization with progressive manufacturer. State previous experience in detail. AS-312, Elec. World.

**Desires Position Immediately in Sales Work.**
Captain machine gun corps just discharged, college graduate, 4 years sales and executive experience in electrical lines before joining army. Will go anywhere. AS-315, Elec. World.

**Electric Motorman Wanted at Once**
With high school education; one familiar with Detroit business conditions and locality preferred. Salary and commission; producers only need apply. State experience and salary desired. Scott Bros. Electric Co., 34 Macomb St., Detroit, Mich.

**English Firm of Electrical Engineers**
Will consider representing good electrical display advertisements for European markets. Principal in America middle of December. AS-313, Elec. World.

**Salesman Wants Connections**
Sales engineer returning soon to the Pacific Coast desires agency. Reply AS-278, Elec. World.

**Electrical Supply Salesman**
Wanted; familiar with the electrical supply equipment, preferable Westinghouse experience. Advise qualifications and salary expected in first letter. Address reply to Box No. 269, Winchester, Ky.


# THE KEY
## To Pittsburgh and Chicago
## For Your Product

There are two types of manufacturers. One has no representative in Pittsburgh and Chicago, but needs them—the other has them, but seeks better connections.

If you fall in either class write us at once. Here's a lifetime opportunity—the key to these cities.

We can add one more product to those we handle. The one we add gets the benefit of a crack sales force—backed by Duquesne prestige—a corps of experts who have a long and intimate acquaintance with every industrial activity at these points—who are thoroughly experienced, particularly from an engineering standpoint and have a knowledge of reconstruction plans.

This is ideal cooperation for a manufacturer who needs "live" representation.

***Write or wire for details.***

**DUQUESNE ELEC. & MFG. CO., Pittsburgh**


## EDUCATIONAL

ELECTRICAL ENGINEERING—Practical one-year course. Thorough training in mathematics, mechanics, applied electricity and drafting, including actual installation, operation, testing and repair of electrical machinery and testing of steam and gas engines; also one-year course in mechanical engineering. New buildings and equipment. Send for catalog. Detroit Technical Institute, Detroit, Mich.

## PROPOSALS

TREASURY DEPARTMENT, Supervising Architect's Office, Washington, D. C., December 14, 1918.—Sealed proposals will be opened in this office at 3 p.m. January 14, 1919, for addition to conduit and wiring and lighting fixtures, in the United States Post Office, Court House, etc., at Troy, New York, in accordance with the specification and drawings, copies of which may be had at this office or at the office of the Custodian, Troy, N. Y., in the discretion of the Supervising Architect. James A. Wetmore, Acting Supervising Architect.

TREASURY DEPARTMENT, Supervising Architect's Office, Washington, D. C., Dec. 5, 1918. Sealed proposals will be opened in this office at 3 p.m., Jan. 3, 1919, for conduit and wiring, and lighting fixtures, in the old United States courthouse, Des Moines, Iowa, in accordance with drawings and specifications, copies of which may be had at this office or at the office of the custodian, Des Moines, Iowa, in the discretion of the Supervising Architect. James A. Wetmore, Acting Supervising Architect.

TREASURY DEPARTMENT, Supervising Architect's Office, Washington, D. C., December 16, 1918.—Sealed proposals will be opened in this office at 3 p.m., January 14, 1919, for extensions to conduit and wiring, lighting fixtures, etc., in the United States post office, customhouse, and courthouse, Utica, N. Y., in accordance with drawings and specifications, copies of which may be had at this office or at the office of the custodian, Utica, N. Y., in the discretion of the Supervising Architect. James A. Wetmore, Acting Supervising Architect.

N. B.—Bidders are required to return the drawings and specifications without marks, notes, or other mutilations.

The Government frank sent to intending bidders is to be used for the return of drawings and specifications and for no other purpose.


# YOU HAVE 3 ALTERNATIVES
## when determining the disposition of idle
# USED EQUIPMENT

***USE IT*** ***SCRAP IT*** ***SELL IT***

**If it is not fit to use, scrap it. If it's too good to be scrapped, sell it.**

***The*** SEARCHLIGHT ***Section*** **will help you find a buyer for it.**

SUPPOSE you hung your rugs ou in the wind, would any more than the loose surface dirt blow out? Of course you know the answer. And that answer ought to sell you the Hoover as the Suction Cleaner to sell to your Customers.

While all vacuum cleaners supply a current of air (suction) to carry away the surface dirt, the Hoover is the only one with a motor-driven beating-sweeping brush which loosens the imbedded dirt so the air current can carry it away. The revolving brush of the Hoover also quickly and effectually removes the lint, hair, threads, etc., which the ordinary vacuum cleaner will not remove.

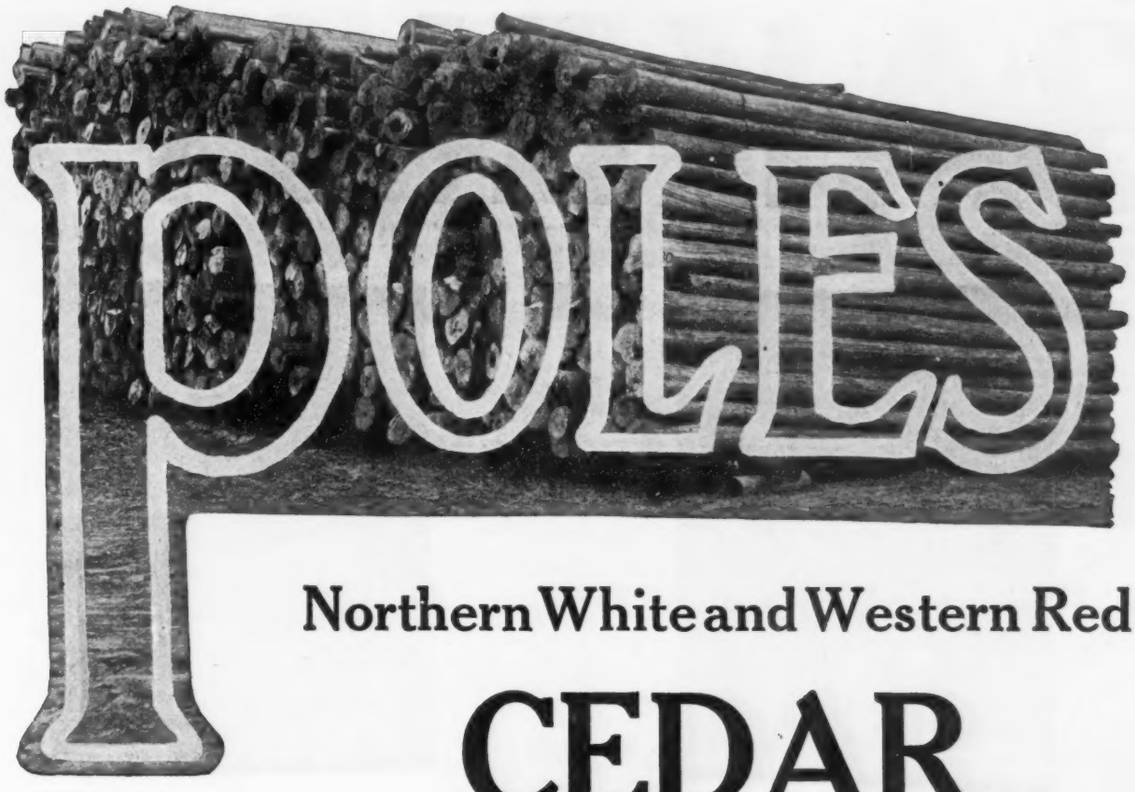
Real satisfaction can come only when the floor-coverings are thus made clean through and through; then only will the Customer continue to delight in using the Cleaner and think well of the Merchant from whom it was bought.

The HOOVER
electric suction sweeper

can be depended upon to create real satisfaction with the customer and with the dealer. Witness only a few sales records of Hoover dealers: Sanger Bros., Dallas, sold $1169. worth of Hoovers in 1916, $62,308. in 1917; Erner Electric Co., Cleveland, $20,487 in 1916, $63,925 in 1917; Hale Bros., San Francisco, $7,687 in 1916, $21,331 in 1917.

Let us send you descriptive booklet 208 and tell how many other progressive dealers all over the country have "cashed in" on our superior product backed by liberal popular advertising.

**Hoover Suction Sweeper Company**
**North Canton, Ohio, U. S. A.**
**For Canada: Thompson Block, Windsor, Ont.**
**The World's Oldest, Largest and Most Successful Manufacturer of Electric Cleaners**




Northern White and Western Red

# CEDAR

*ANY QUANTITY*
*ANY SIZE*
*ANY TIME*

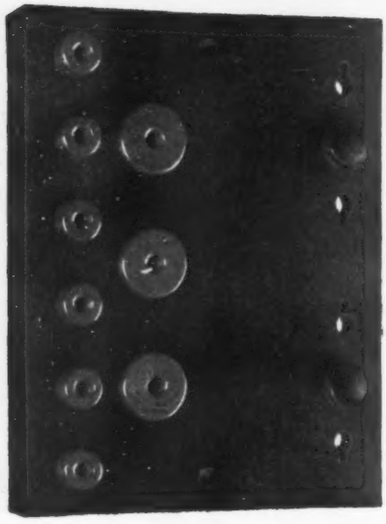
SHIPPING YARDS:
Minneapolis, Minnesota
Duluth, Minnesota
Gladstone, Michigan

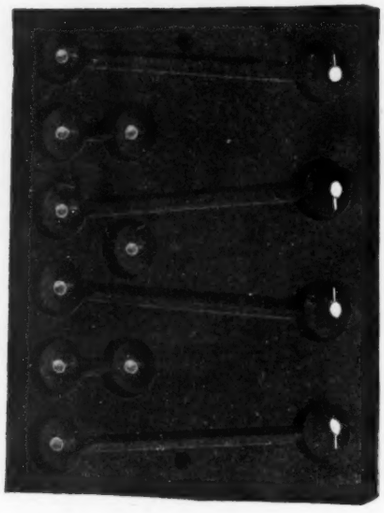
## THE MacGILLIS & GIBBS COMPANY

Milwaukee, Wisconsin

# BAKELITE

REG. U. S. PAT. OFF.





## Incorporate Metal Inserts When Moulding

The superior moulding qualities of Bakelite and the fact that metal inserts may be incorporated in a piece when it is being moulded make it incomparable for this class of work.

A "piece" leaves the mould clean, smooth and sharp and with inserts permanently located in exactly the positions desired.

Bakelite will not warp, swell or bloom with age and possesses high dielectric strength. It is homogeneous and non-hygroscopic and is indifferent to heat, water, steam, solvents and most chemicals. It is the ideal moulding material for electrical purposes.

If your work is not in sufficient volume to warrant the maintenance of your own moulding department, there are Bakelite licensees who will do it for you on a contract basis.

**The GENERAL BAKELITE COMPANY,** 2 Rector Street, New York, welcomes inquiries from manufacturers and maintains a research laboratory for the working out of new applications.

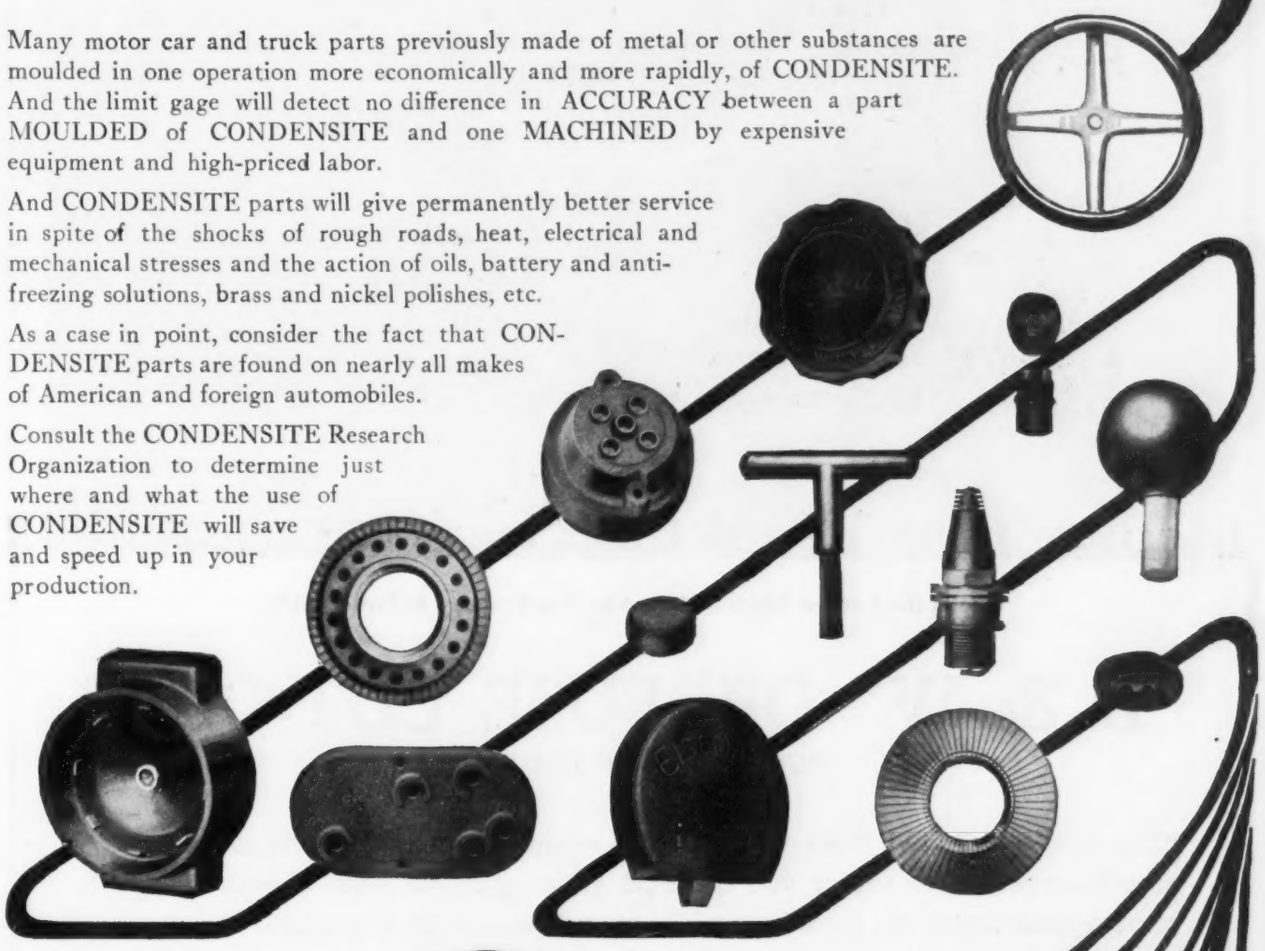
# Condensite

Many motor car and truck parts previously made of metal or other substances are moulded in one operation more economically and more rapidly, of CONDENSITE. And the limit gage will detect no difference in ACCURACY between a part MOULDED of CONDENSITE and one MACHINED by expensive equipment and high-priced labor.

And CONDENSITE parts will give permanently better service in spite of the shocks of rough roads, heat, electrical and mechanical stresses and the action of oils, battery and anti-freezing solutions, brass and nickel polishes, etc.

As a case in point, consider the fact that CONDENSITE parts are found on nearly all makes of American and foreign automobiles.

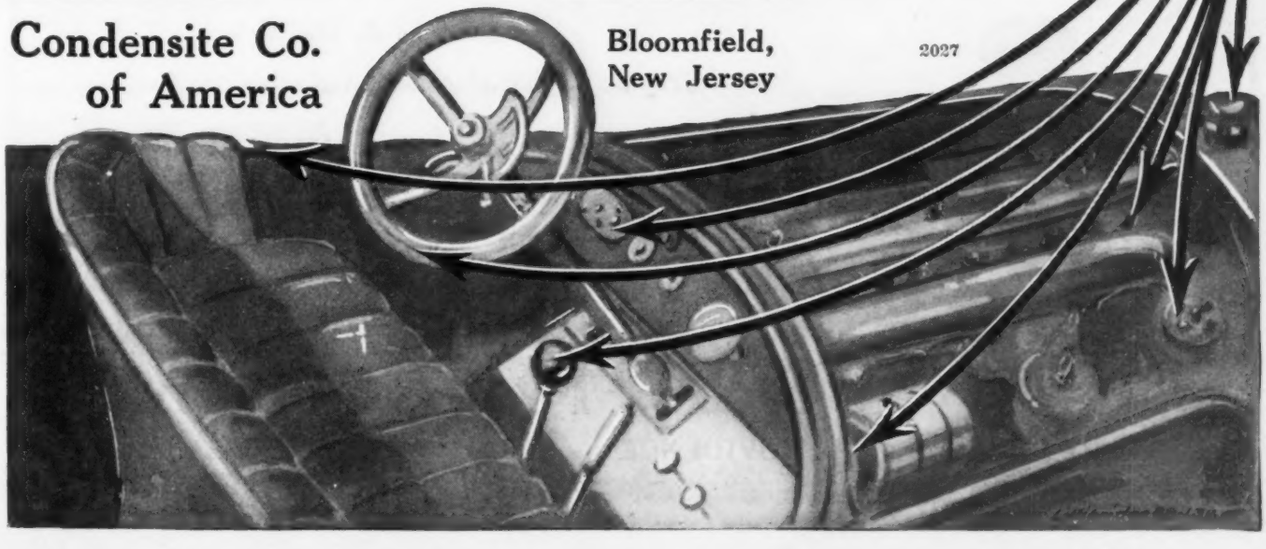
Consult the CONDENSITE Research Organization to determine just where and what the use of CONDENSITE will save and speed up in your production.



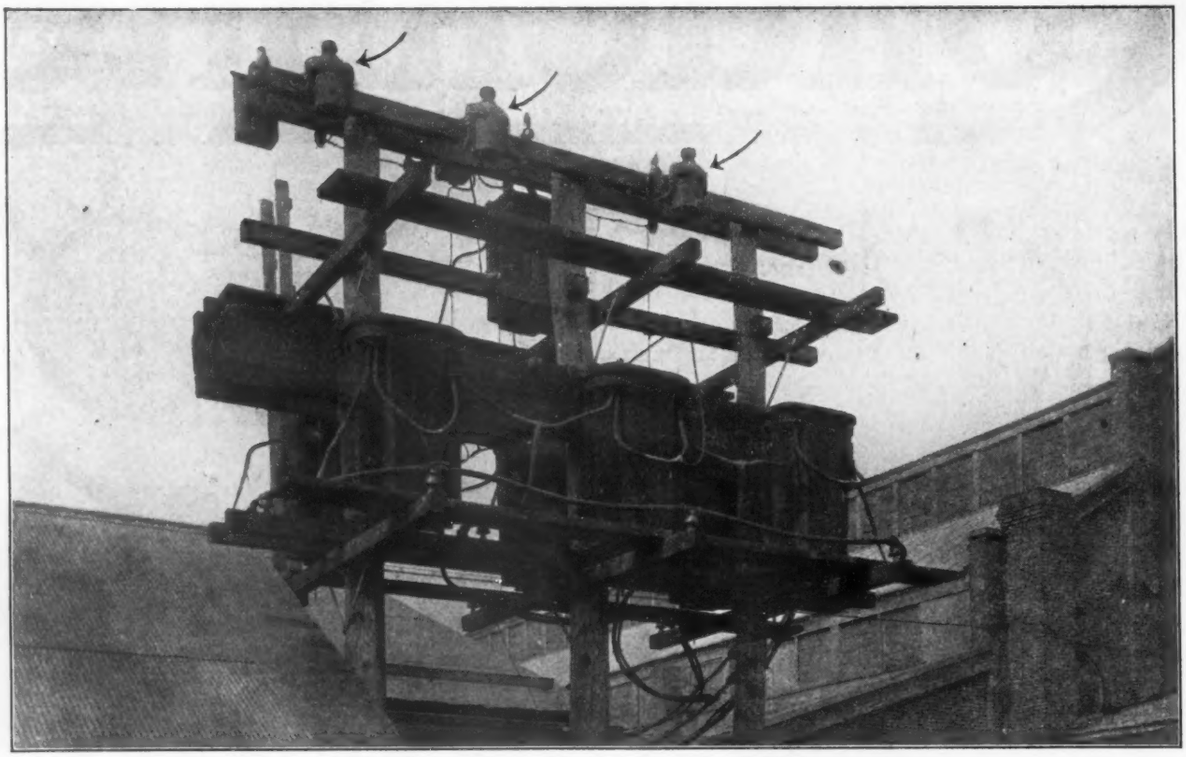
**Condensite Co. of America**

**Bloomfield, New Jersey**

2027



# "GUARDIANS OF THE LINE"



One of the Largest Machine Shops in This Country Is Protected by

# "D & W" OIL FUSE CUT-OUTS

*"GUARDIANS OF THE LINE"*

"The service required from the electrical equipment of a machine shop such as ours is more or less severe and the load varies greatly. Our Electrical Department reports that these fuses have never caused them a bit of trouble."

LEWIS A. RICE,
Traylor Engineering & Manufacturing Co.,
Allentown, Pa.

POLE LINE TYPE

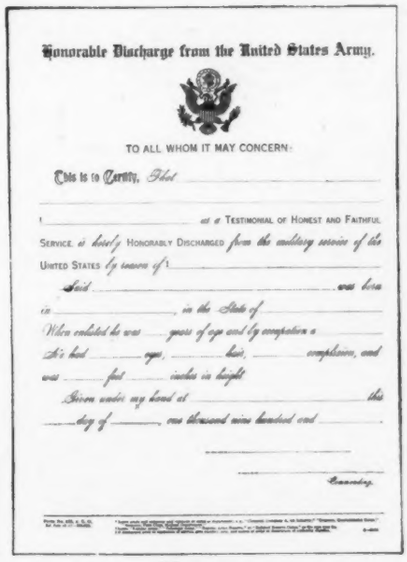
LET US TELL YOU WHAT THEY CAN DO FOR YOU.

SEND FOR CATALOG No. 2

## D & W Fuse Company

PROVIDENCE RHODE ISLAND

# AN HONORABLE DISCHARGE



Honorable Discharge from the United States Army.

TO ALL WHOM IT MAY CONCERN:

This is to Certify, That _____

_____ as a TESTIMONIAL OF HONEST AND FAITHFUL SERVICE, is hereby HONORABLY DISCHARGED from the military service of the UNITED STATES by reason of _____

Said _____ was born in _____, in the State of _____

When enlisted he was _____ years of age and by occupation a _____

He had _____ eyes, _____ hair, _____ complexion, and was _____ feet _____ inches in height.

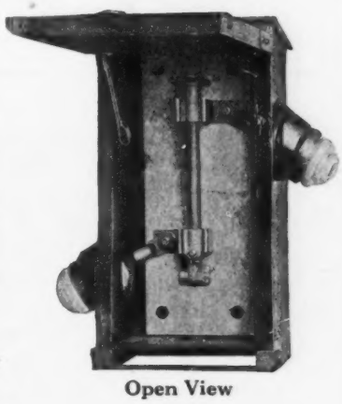
Given under my hand at _____ this _____ day of _____, one thousand nine hundred and _____.

_____

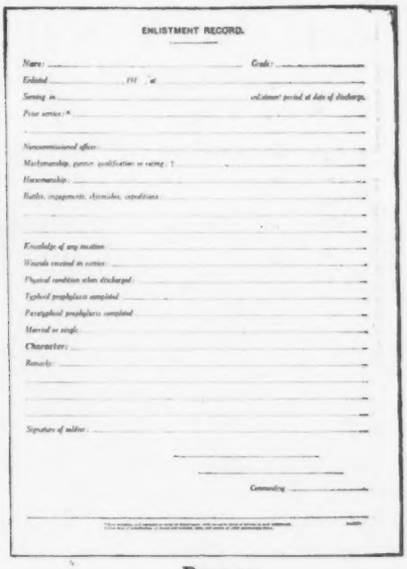
_____

Commanding.

Obverse



Open View



ENLISTMENT RECORD.

Name: _____ Grade: _____

Enlisted _____, 191 _____ at _____

Serving in _____ enlistment period at date of discharge.

Prior service:*

Noncommissioned officer:

Marksmanship, gunner qualification or rating:†

Horsemanship:

Battles, engagements, skirmishes, expeditions:

Knowledge of any trades:

Wounds received in service:

Physical condition when discharged:

Typhoid prophylaxis completed:

Paratyphoid prophylaxis completed:

Married or single:

Character:

Remarks:

Signature of soldier:

Commanding

Reverse

In the next year thousands of our brave boys will receive honorable discharges from the Army and Navy of the United States. The emergency for which they were needed no longer exists. Above is a reproduction of one of these documents which will be prized by all those who possess them.

While the Government does not issue honorable discharges for commodities of which it has had almost the exclusive use during our participation in the War for Civilization, if they did, Matthews Fuswitch would undoubtedly be given one with a notation reading "Character and Record EXCELLENT."

You can now get immediate delivery on Matthews Fuswitches. Those extensions that you have been holding up on account of the War can be protected against interruption of service. You can relieve your trouble department of much unnecessary work by sectionalizing your lines with Matthews Fuswitches. Then when any trouble occurs it can be localized and a minimum number of customers affected and those for the shortest possible time.

You can reduce maintenance costs—fuse renewal costs—accidents to your men and others and by the savings effected more than pay for Matthews Fuswitches every year that they are in your service.

If you have never used them you can order any number over six on thirty days' trial. Pay for them if satisfied that they will save you money. Otherwise return by freight, charges collect.

You can't lose. How many?

W. N. MATTHEWS, PRESIDENT AND TREASURER

MARTIN J. WOLF, VICE-PRESIDENT

CLAUDE L. MATTHEWS. VICE-PRESIDENT AND SECRETARY

## W. N. MATTHEWS & BROTHER

INCORPORATED

MANUFACTURERS OF PATENTED ELECTRICAL SPECIALTIES

ST. LOUIS, U. S. A.

CANADIAN DISTRIBUTERS
THE NORTHERN ELECTRIC COMPANY, LIMITED
MONTREAL, HALIFAX, TORONTO, WINNIPEG, CALGARY, REGINA, VANCOUVER, VICTORIA

DISTRIBUTERS FOR GREAT BRITAIN
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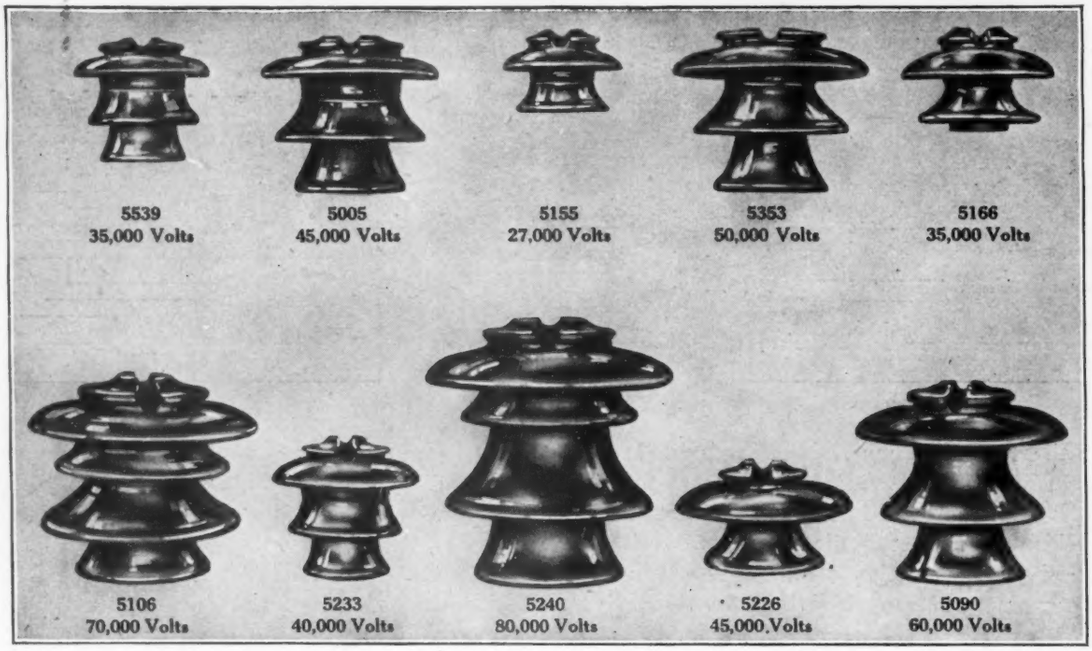
DISTRIBUTERS FOR AUSTRALIA AND NEW ZEALAND
WESTERN ELECTRIC CO. (AUSTRALIA) LTD., SYDNEY, N. S. W.

CODES: A. B. C. & LIEBERS

# CONFIDENCE




Did you ever think, even for a moment, that the American Fighting Forces in Europe would not live up to the past reputation of the American Warrior?

## No!

You knew that the principles upon which the United States was founded would be upheld and protected. You knew that the cause for which they were fighting was just and right, and that every man who went overseas could be counted upon to the limit.

You knew that they had the "Punch." VICTOR Insulators have the reputation of giving maximum efficient service.

## Why?

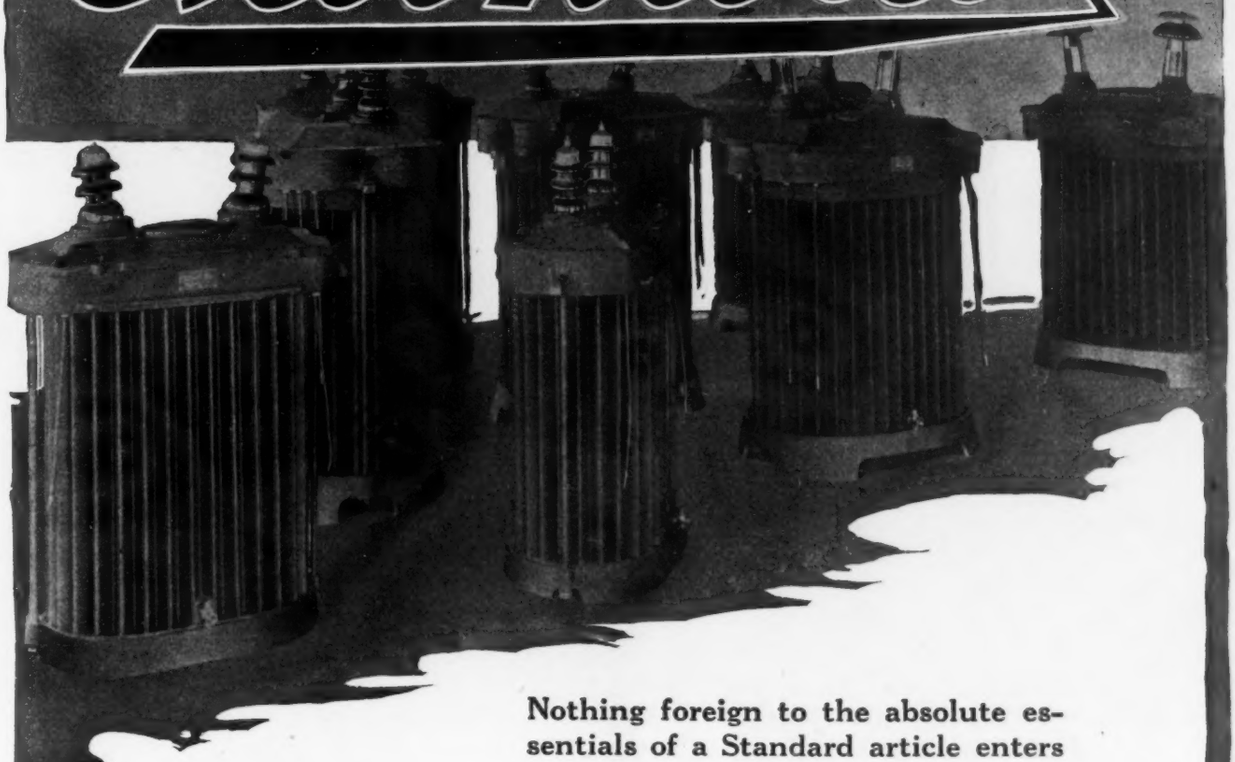
They are correctly designed for the service they are expected to render.

They are made by skilled workmen, and of material of the highest quality. They will protect your interests, eliminate line troubles, and can be counted upon to the limit.

THEY have the "Punch."

**Locke Insulator Mfg. Company, Victor, N. Y.**

# Packard



**Nothing foreign to the absolute essentials of a Standard article enters into the assembling or design of Packard Transformers.**

**Wherever they are installed opinion is unanimous in its verdict as to their dependability and efficient service.**

The Packard Electric Company

**Home Office and Works: Warren, Ohio, U. S. A.**

**DISTRICT OFFICES**

| | |
|---|---|
| **Chicago, Ill.** | F. B. Duncan, Mgr., 400 Lees Bldg., 19 S. Wells St. |
| **Cleveland, O.** | Dingle-Clark Co., Engineers' Bldg. |
| **Denver, Colo.** | Duncan Bond, Mgr., Colo. Natl. Bank Bldg. |
| **Detroit, Mich.** | W. L. Marsh, Mgr., Whitney Bldg. |
| **Los Angeles, Cal.** | J. G. Monahan, Mgr., San Fernando Bldg. |
| **Minneapolis, Minn.** | R. L. Lunt, Mgr., 716-18 McKnight Bldg. |
| **Pittsburgh, Pa.** | B. Rutherfoord, Mgr., First Natl. Bank Bldg. |

**EXPORT OFFICES**

**S. G. Leach Co.**, London, E. C.
Territory: England, Ireland, Scotland.
**A. H. Keleher Co.**, New York.
Territory: South America.
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## Have a Look

at the ORANGEBURG Fibre Conduit being installed. Look at the eight liberally large ducts easily laid—perfectly aligned—in the narrow trench. Look how round and true every duct is—how smooth appearing the interior as exposed at the ends. ORANGEBURG Fibre Conduit makes "pulling in" an easy job. Write for further information.

**THE FIBRE CONDUIT COMPANY**
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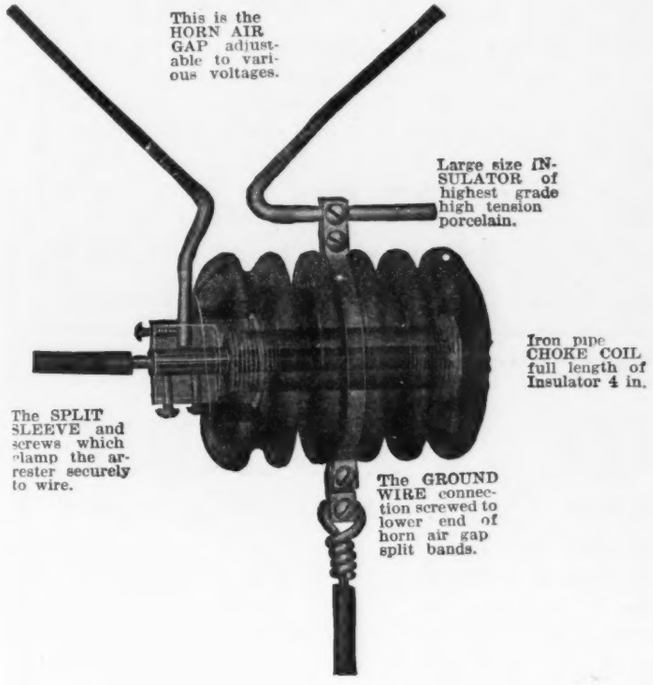
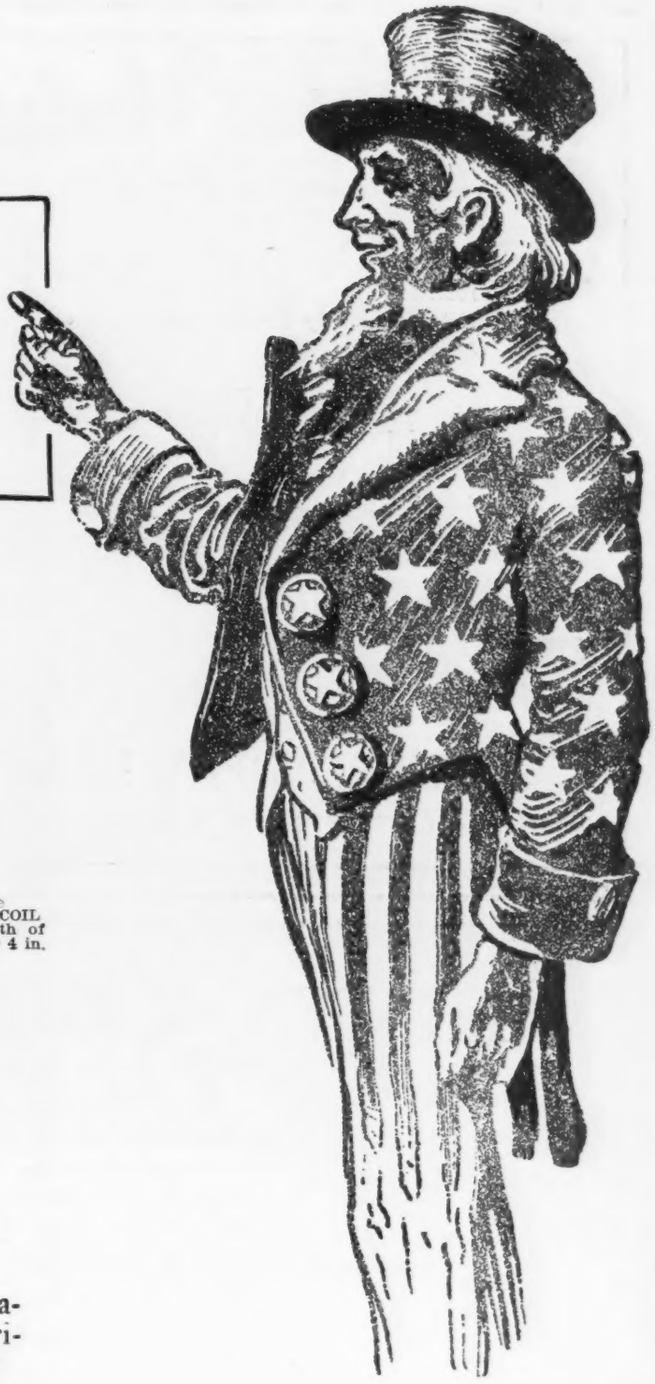
**With the Central Station capacity of the country operating at maximum to turn the nation's war machinery, it is the duty of every Central Station Manager to protect in every possible way the continuity of his service.**


This is the HORN AIR GAP adjustable to various voltages.
Large size INSULATOR of highest grade high tension porcelain.
Iron pipe CHOKE COIL full length of Insulator 4 in.
The SPLIT SLEEVE and screws which clamp the arrester securely to wire.
The GROUND WIRE connection screwed to lower end of horn air gap split bands.



Are your lines protected from that occasional flash of lightning which may seriously hamper the nation in its war work?

You can get almost 100% protection if you follow the lead of the over 700 Central Stations who now protect their lines by more than **8000 Peirce Universal Lightning Arrestors.**

**Ask today about our "money back" guarantee.**

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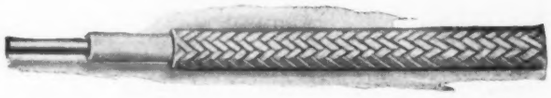
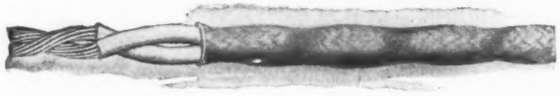
**Canadian Manufacturers and Distributors: Acme Stamping & Tool Works, Hamilton, Ontario**

# Asbestos Insulated Wires

*for* steel mill motor connections, searchlights, controllers, moving picture machines, switchboards, electric ovens, heaters, etc. Special insulation for pyrometers.

*All approved by Underwriters Laboratories, Inc.*





## Also ENAMEL Magnet Wire

This is a new product in addition to our standard Salamander Pure Asbestos Insulated Magnet Wire. We are prepared to furnish it either plain or with silk or cotton covering.

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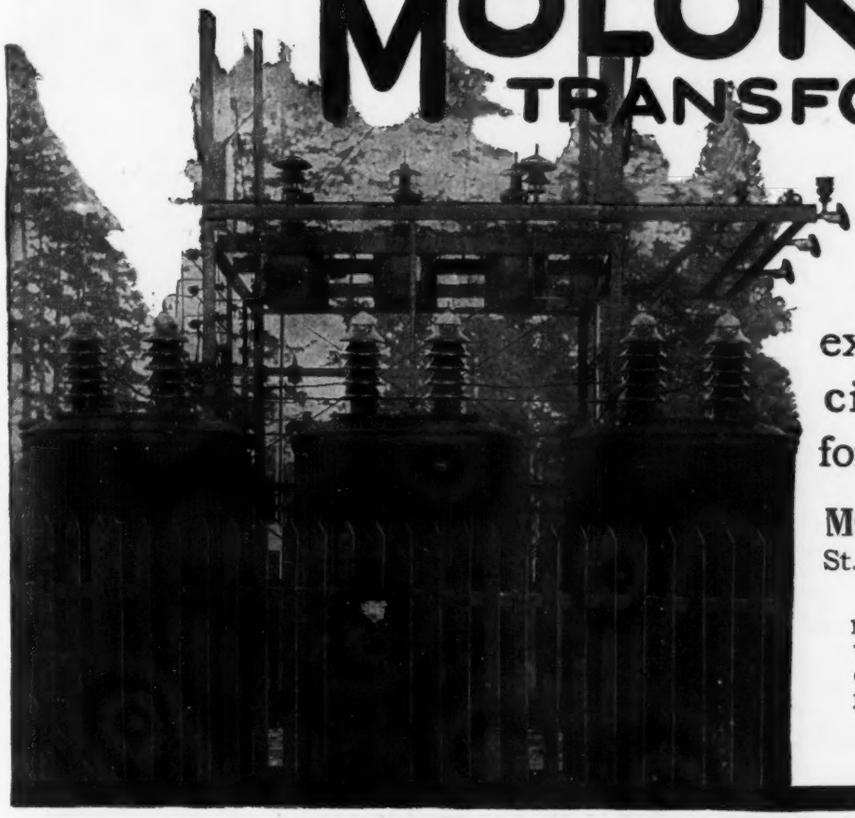
**Electrical Testing Laboratories**

**80th St. & East End Ave., New York City**

# MOLONEY TRANSFORMERS



represent the results of thirty years' experience and specializing in Transformers only.

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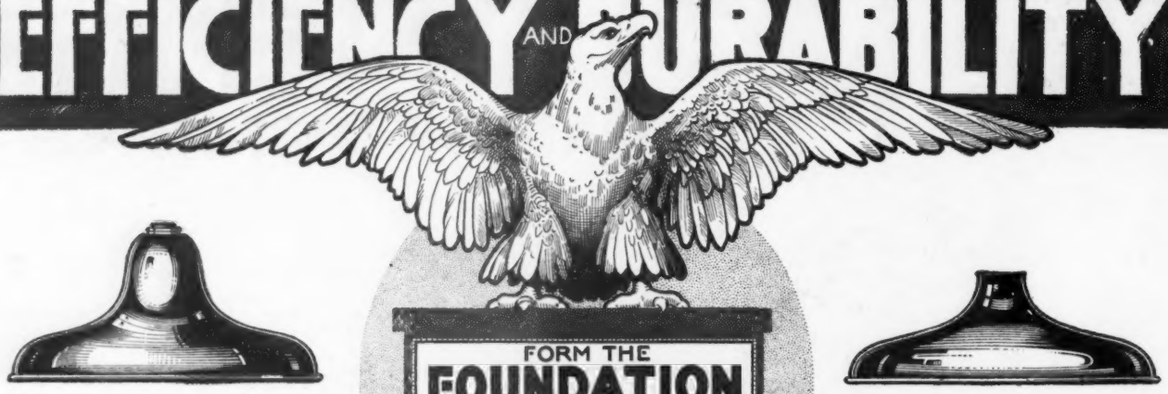

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1919

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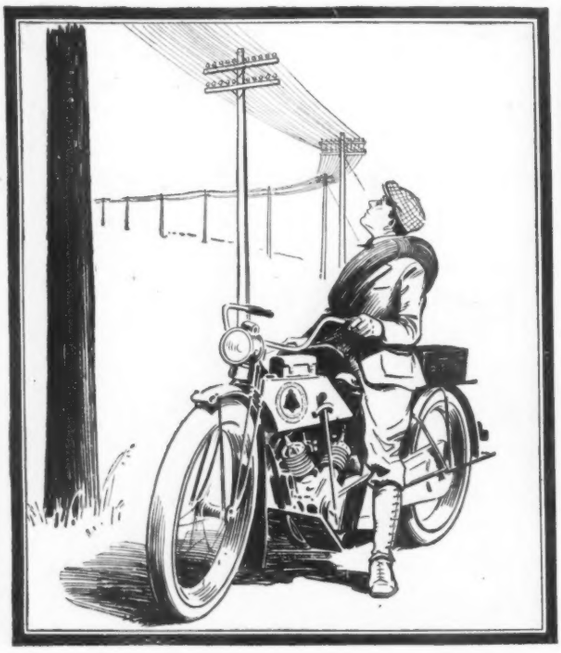

Good telephone service requires the absolute perfection in every detail of apparatus and equipment. Every bit of outside plant as well as central office equipment must be constantly under supervision. The war has drawn heavily upon the skilled telephone men, yet the constant vigilance essential to good telephone service must be maintained.

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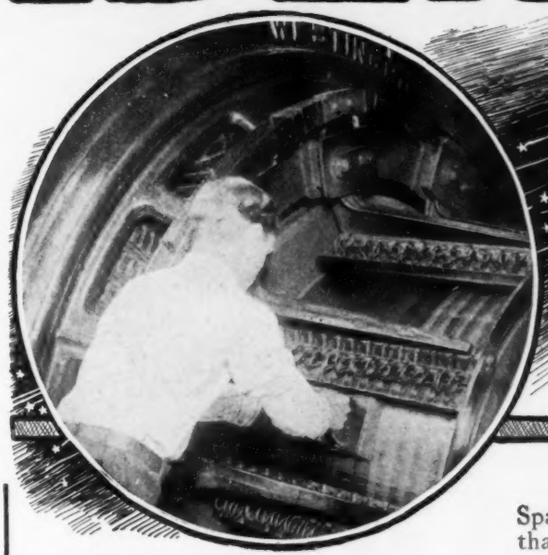
# IDEAL COMMUTATOR RESURFACERS



WILL STOP THAT SPARKING!

Sparks from your commutators mean wasted power. Stop that sparking by resurfacing your commutators while running under load, with the Ideal Commutator Resurfacer. Just hold this new abrasive block against the revolving commutator and it will cut down the high mica, ridges and high bars, leaving a perfect commutator surface. The Ideal Resurfacer is non-metallic and will not collect copper or cause short circuiting.

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Try the Ideal Resurfacer at our expense. Write us giving the approximate r.p.m., diameter, surface width, condition and distance between brush sets of your worst commutator or collector rings. We will then send you an Ideal Resurfacer for ten days' free trial. Write the Ideal Commutator Dresser Co., 6 South Dearborn St., Chicago.

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**The non-metallic, flexible conduit you should buy—for economy's sake and for your wiremen's sake. FLEXTUBE samples and descriptive Bulletin No. 151 sent on request.**

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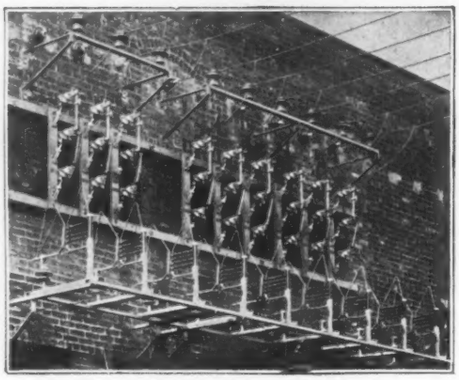
HIGH TENSION EQUIPMENT

# High-Speed Lightning Arresters

## Disconnect Switches—Limit Fuses



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THIS installation is made up of standard "Unit-Type" parts *shipped from stock!* The Limit Fuse will open in .013 of a second thus preventing excessive current flow with consequent damage liability.

Our bulletins show oscillogram records of this operation. *Want Your Copy?*

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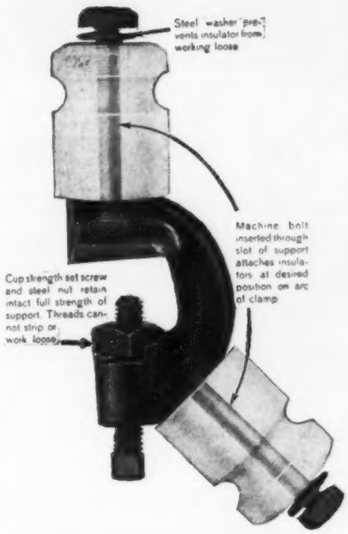
# SAVING ON INSTALLATION COSTS


Steel washer prevents insulator from working loose
Machine bolt inserted through slot of support attaches insulators at desired position on arc of clamp
Cup strength set screw and steel nut retain intact full strength of support. Threads cannot strip or work loose

*The Efficiency Adjustable Insulator Support Made in four sizes.*

***No Tapping—No Drilling***
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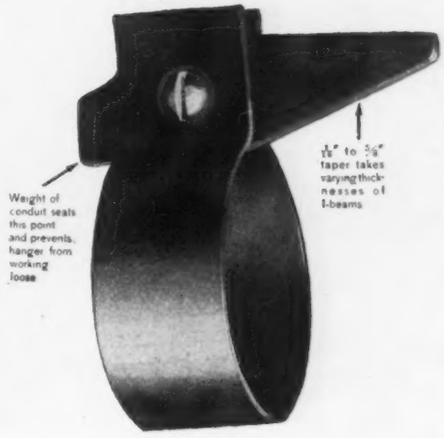
One-third to one-half your installation costs can be saved by using Efficiency Electrical Fittings.

These devices clamp solidly to columns, girders, shapes, etc., rendering unnecessary tapping and drilling for even the most difficult wiring job.

Still another advantage is their adaptability for carrying lines parallel with and at right angles, or both, to I-beams, under, on top of or at the side of structural steel.

**Write for Catalog No. 2**


Weight of conduit seats this point and prevents hanger from working loose
1/16" to 3/4" taper takes varying thicknesses of I-beams

*The Efficiency Conduit Hanger, Type A. Made in ½-in. to 4-in. sizes.*

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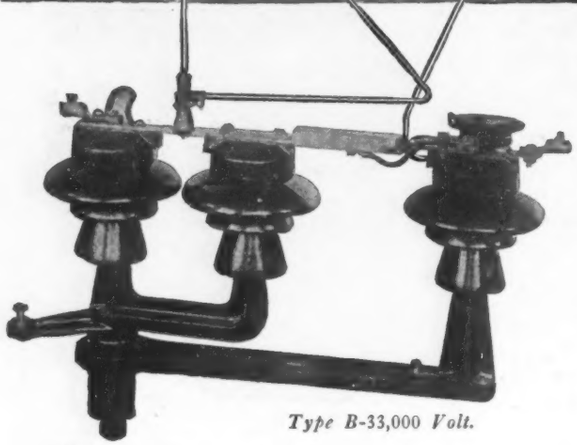
***Every electrical engineering and manufacturing facility of this company is again engaged in the work of construction for peace-time needs.***



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Sleet and winter storms will not freeze up the Burke Switch. Every point is successfully guarded against this danger. The main contact is of the laminated leaf brush type, completely covered by a sleet hood, guaranteeing operation under the severest weather conditions.

*Prepare now for winter weather—*
*Write today for descriptive Bulletin W.*

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THE HORN GAP SWITCH WITH LAMINATED LEAF BRUSH CONTACT

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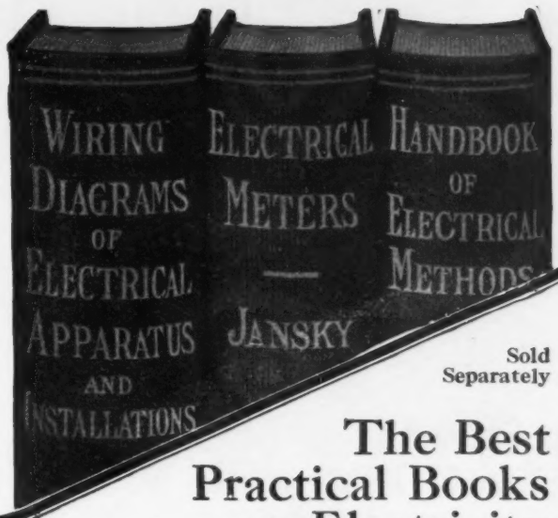
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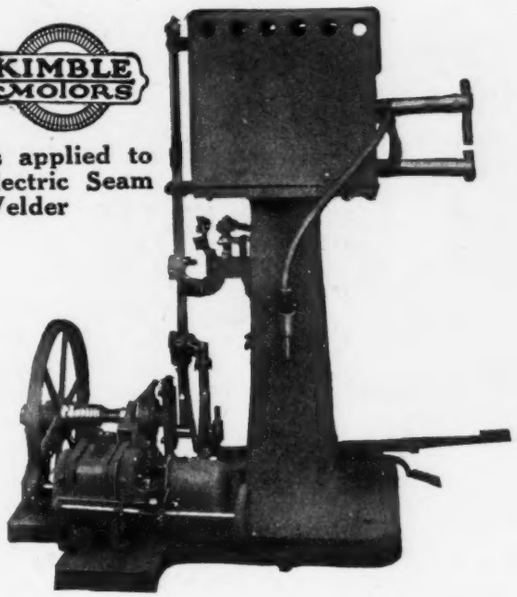
as applied to Electric Seam Welder



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This time it is the Thomson Electric Seam-welder, for welding longitudinal seams on cans, boxes, stove parts, etc.

The Kimble adjustable speed alternating current motor is applied to drive the welding roller back and forth between the two copper horns—slow speed for thick stock; quicker speed for thin stock. Speed is instantly controlled by hand wheel. Motor speed ranges from 600 to 1800 r.p.m., by infinitesimal gradations, giving operator flexible and positive control at all times.

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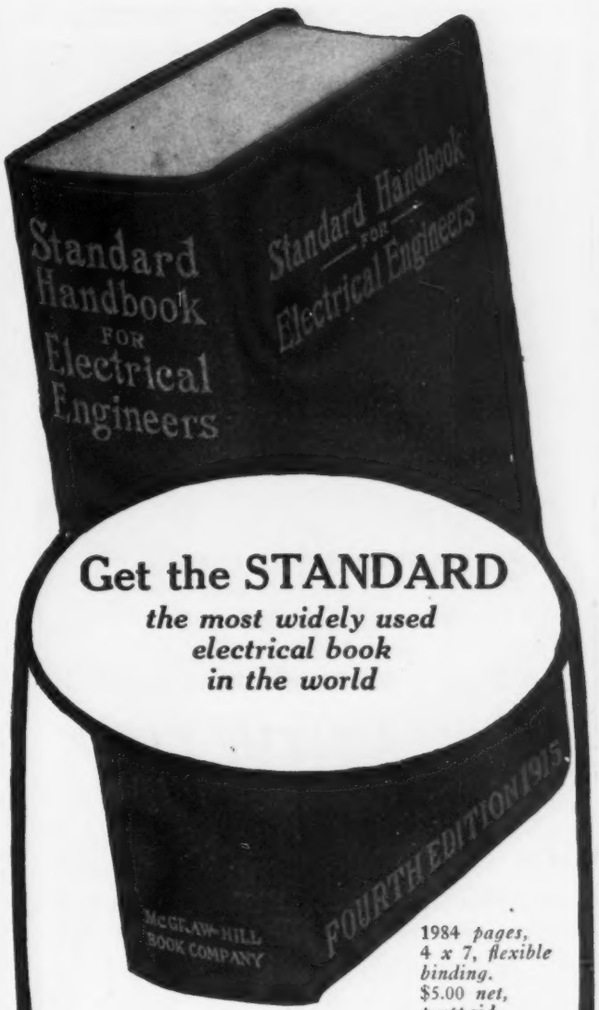
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**SAFETY SERVICE SWITCH**

the switch that gives positive protection to both operator and equipment. It is entirely enclosed and is operated from the outside—the box cannot be opened until the switch is in "off" position.

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**(A higher development of vulcanized cotton fibre.)**

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*Vul-Cot* Fibre is sold in sheets, rods and tubes or machined to your specifications.

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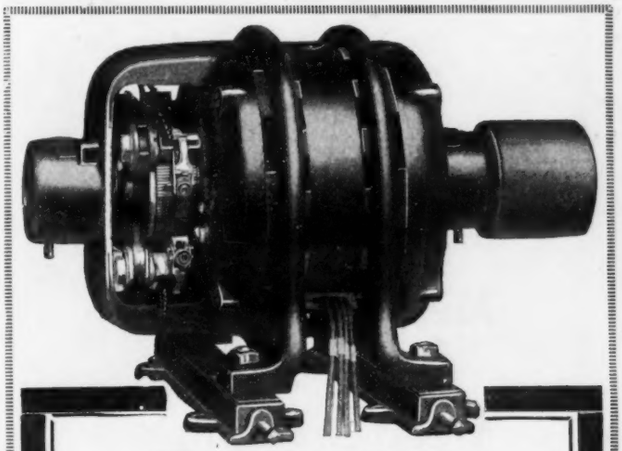
MONTREAL TORONTO WINNIPEG OTTAWA HALIFAX CALGARY REGINA VANCOUVER



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***—the ideal Variable-Speed Motor for Cylinder Press Drive***

Push Button Control, predetermined set speeds, dynamic brake and no-voltage release—these are some of the operating advantages of the "AK" in the exacting service requirements of cylinder press drive.

Made for A.C.—any cycle—1/20 to 6 H.P.

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# There's Satisfaction in a Daum Fuse

The initial cost of the Daum is less than the old-style "one-time" fuse—

They are so easily and cheaply refilled, too—unscrew the cap, insert a piece of new fuse element from the roll of Daum Fuse Stripping, and the Fuse is again ready for service.

***Sole Manufacturer***

**A. F. DAUM**

**Pittsburgh, U. S A.**

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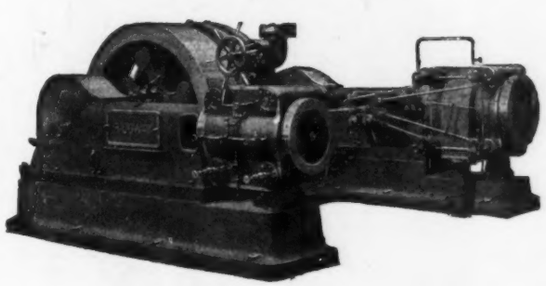

Are made as a single piece of machinery—
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But Actually Made as a *Unit*.
That's why they run so silently, so smoothly and so economically.

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3

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Bates Steel Poles are becoming universally popular world wide. Repeat orders testify their general suitability for every Pole purpose.

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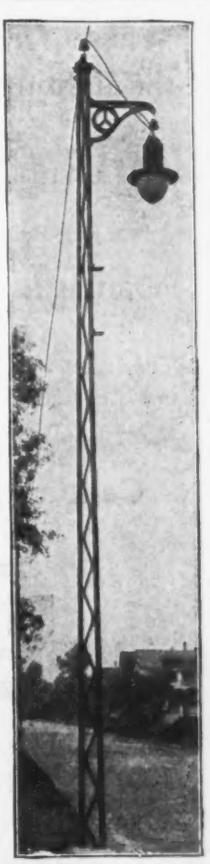
**Tubular Steel Poles cost 50% more than Bates Steel Poles, yet Bates Poles are 100% stronger—will last 100% longer, cover a much broader range of adaptability and are much more artistic than Tubular Poles. Ask us to verify these facts.**



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Cost *no more* than carbons to buy and *half* as much to operate.

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## Metal Boxes
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**Repulsion—Start—Induction**

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**1/10 to 1/4 H.P.**

They require less than 3 times full load current to start and accelerate to full speed in 2 to 10 seconds.

**Century Electric Company**
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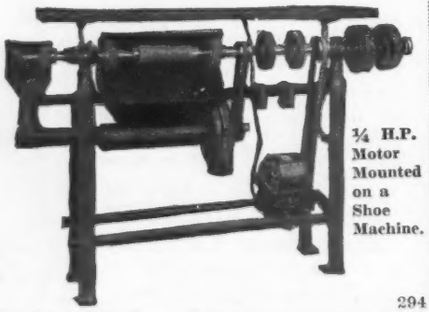
*Sales Offices in Principal Cities*



**¾ H.P. Motor Mounted on a Shoe Machine.**

**Other Sizes Up to 40 H.P.**

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**Portable Lamp and Scale Galvanometer**

A suspension type d'Arsonval Galvanometer with Lamp and Scale—all in a single unit. About twenty times as sensitive as the best portable pointer instrument. Rugged as the ordinary voltmeter. We use it in many of the "working set-ups" in our own laboratory, and find it extremely popular there.

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Then by all means equip your men with good tools. It's the only way to overcome the shortage of labor. Select a special tool for every purpose. Let each gang have a complete set, then every gang you have will do more work and do it with pleasure—without added energy.

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***Oshkosh Construction carried in stock by leading jobbers and all Western Electric Branch Houses***

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This trade-mark — always in red — on every Hygrade lamp and carton—a mark of progress in economical lighting.

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***The new Hygrade C 75-watt gas-filled lamp is now ready***

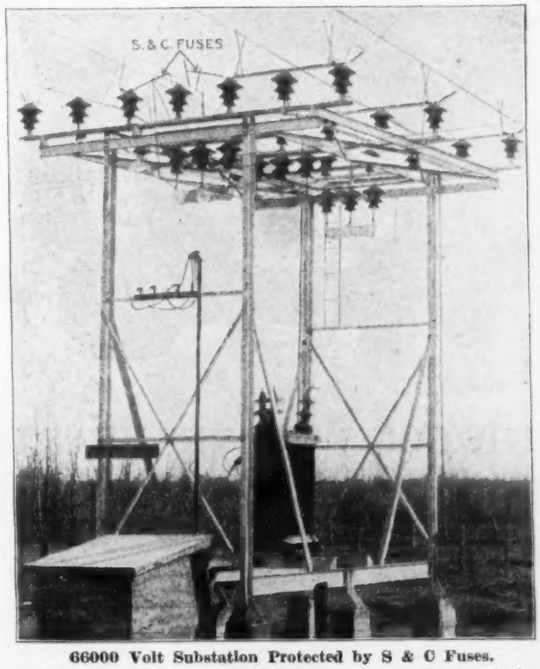
As has been the case with all Hygrade lamps this 75-watt lamp is offered you only after we have proved to ourselves that it will permanently live up to every claim we make for it.

It has an average life of 1000 hours, a spherical candle power of 69 and consumes less electricity per candle power than any tungsten-vacuum lamp.

HYGRADE LAMP CO

GENERAL OFFICE AND FACTORY SALEM MASS



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Fuses for all voltages to 150,000 volts and all currents to 500 amperes.

*Ask for Fuse Bulletin.*

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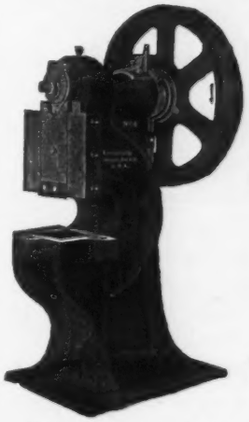
# Increased Profits On Electrical Stampings are Effected by BLISS Machinery



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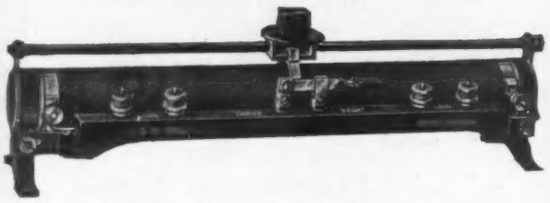
# JAGABI
## ADJUSTABLE RHEOSTAT



"Jagabi" Sliding Contact Tube Rheostat

A good assortment of convenient rheostats is a great asset in any laboratory—and reliable rheostats are essential for proper operation of many commercial devices.

"Jagabi" Sliding Contact Tube Rheostats are regularly made for currents from .3 ampere to 25 amperes with corresponding resistance from 3000 ohms to .7 ohm. Most requirements can be supplied from standard sizes. If unusual conditions must be met we are prepared to offer special rheostats to suit.

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## Galvanized Conduit

Made for users who want the best. XDUCT is a high-grade conduit designed and made with a view to meeting all the requirements essential to precise work in electrical wiring.

Made from easy bending Spellerized Mild Steel Tube. Protected from rust by a heavy deposit of pure, non-corrosive zinc. Enameled inside with especially prepared black enamel which forms a smooth, glossy interior, through which the wires are easily fished.

Furnished in 10-foot lengths, reamed and threaded on both ends, with coupling on one end.

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The failure of a coil may cause serious delay to your production, therefore you should insist on the best coils obtainable.

Our facilities enable us to meet your requirements, no matter how unusual. Our coils are wound by specially trained operators on precision machines—work right—prices right.

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**Reliable, accurate and durable**
***"Wind it once a week"— the clock does the rest.***

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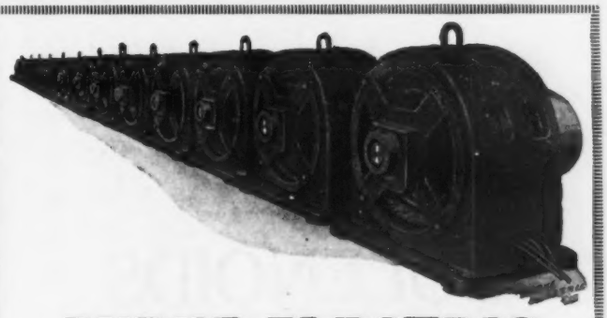

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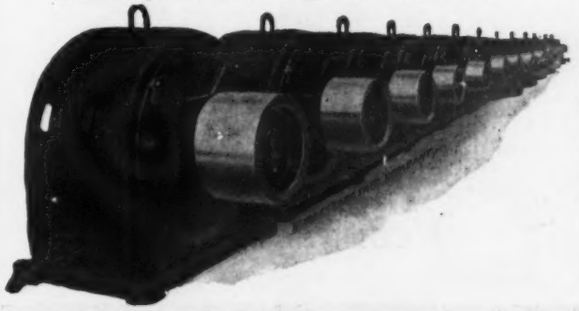

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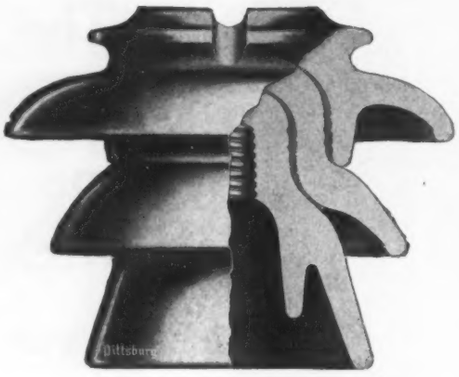

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OUR customer who purchased these transformers is unable to use them on account of current shortage.

We are following our policy of SERVICE in assisting our customer in disposing of this equipment. Write for prices on this lot.

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One of the principal advantages of the interweave coil is the ease with which it may be impregnated. It is impossible to satisfactorily impregnate the close layer windings of enameled wire, especially when small sized conductors are used. To provide space for penetration of compound, it has been customary to use cotton or silk covered wire. Interweave coil windings accomplish the same result, with a reduction in space occupied by the insulating material; also the use of high-grade enamel insulation is made possible.

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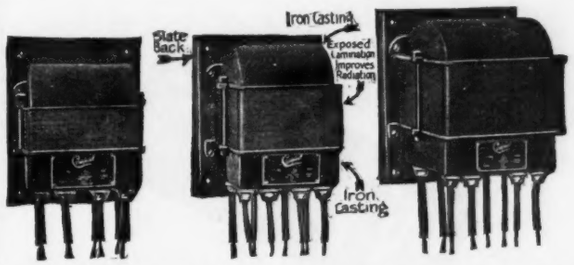


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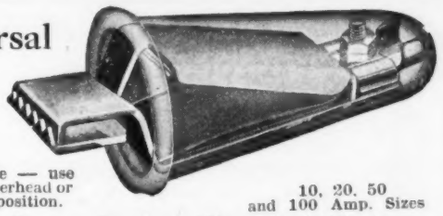

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Unexcelled for test sets, meters, transformer and motor test floors, shop test benches, college and commercial laboratories, motion picture projection work and storage battery charging.

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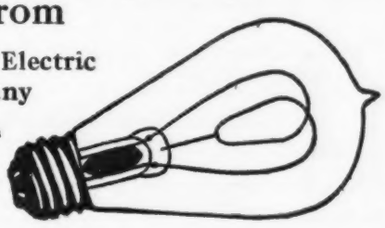

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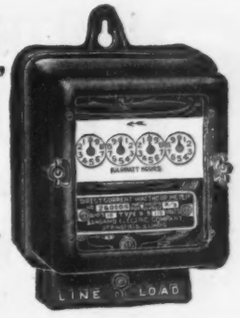


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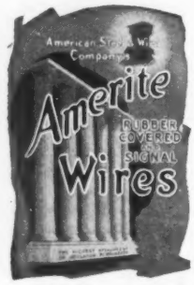


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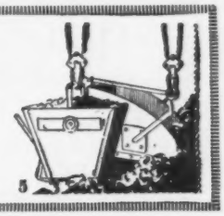

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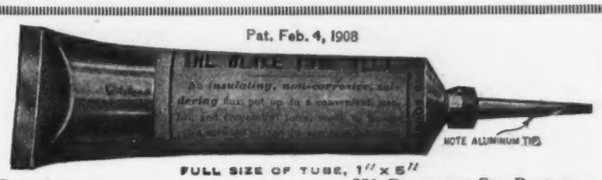


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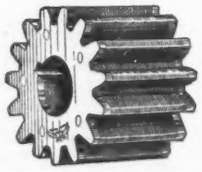

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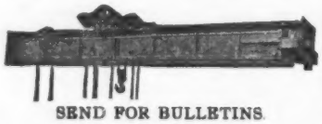
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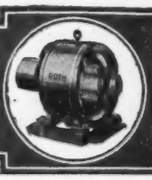
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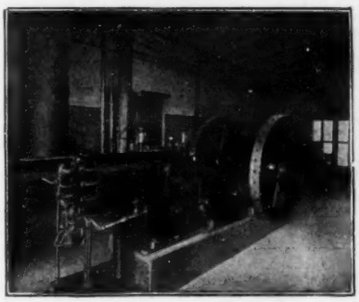

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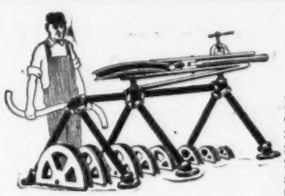

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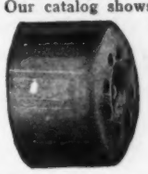

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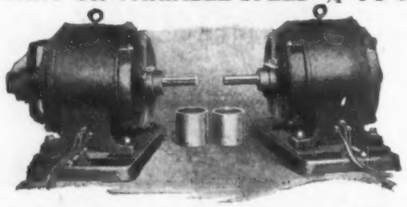

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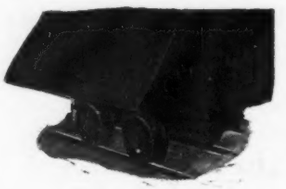

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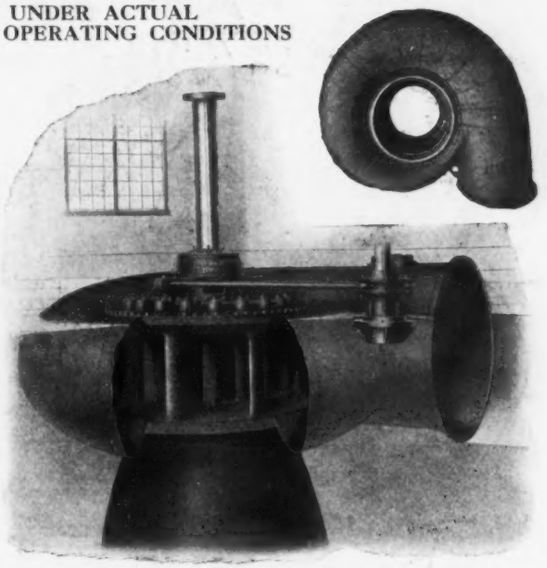
# 92% EFFICIENCY

UNDER ACTUAL OPERATING CONDITIONS



The accompanying illustration shows a single, vertical shaft wicket gate SMITH HYDRAULIC TURBINE in a plate steel scroll case with all gate operating mechanism on the outside. This unit is in successful operation under 60 ft. head developing 3,000 brake horse power at 240 revolutions. After installation it was tested by disinterested engineers and established the above performance record under actual operating conditions.

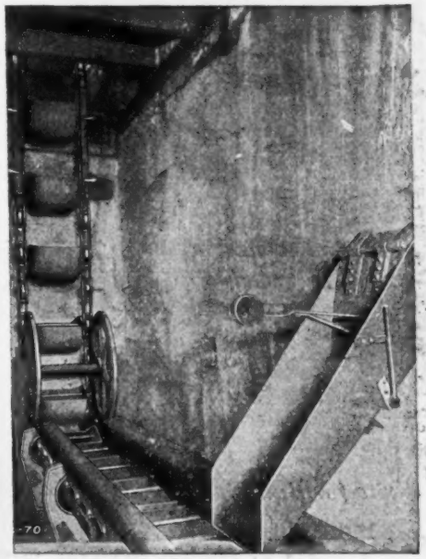
*Write Dept. "W" for Bulletin of Designs*

## S. MORGAN SMITH CO., York, Pa.

176 Federal St. Boston | 76 W. Monroe St. Chicago | 461 Market St. San Francisco | 405 Power Bldg. Montreal

# Eliminate Annoyance

Close study of the mechanical requirements adapted to best control the flow of bulk material has resulted in the production of *"Hunt" valves and gates*, now the recognized standard, and free from the usual faults of clogging and choking.



The cut shows an efficient combination of gate and pivotal conveyor—both "Hunt" products which, united, form the most effective combination known for shifting coal, ashes or like material.

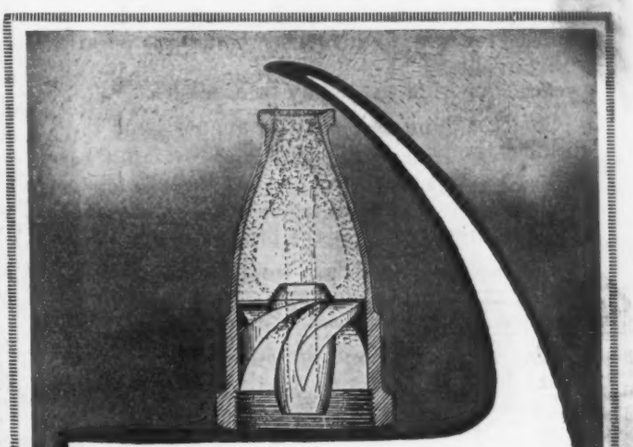
*Circular on application.*

## C. W. HUNT CO., Inc., New York

**Sales Office:**
501 5th Ave. at 42nd St.

**Works and Executive Office:**
West New Brighton, N. Y.

Branch Sales Offices: Chicago Washington Boston Philadelphia



# Even Atomization

The "SPRACO" patent nozzle produces even atomization from center to outside edge of the spray—twice the cooling capacity with half the water used by ordinary nozzles.

Our latest Bulletin tells how and why the "Spraco" patent nozzle is the most efficient for air washers and spray cooling ponds. Specify

## "SPRACO" PRODUCTS

**Spray Engineering Co**
93 Federal St., Boston, Mass

# Lalit

The Hindu songs have no catchy headline to sell them.

They are known simply by certain representations.

As an instance the Lalit morning song is represented as a luxurious and aristocratic figure reclining on a flower divan with little to protect her from the balmy atmosphere.

Come to think of it that's a mighty good way to label things.

We certainly wish that instead of trade marks and trade names on brushes they would give representations of what the brushes stand for.

The cheap carbon brush would be represented by the *chattering* commutator, the *overwhelmed* operator and the *exasperated* executive.

The representation of Morganite service would be more like that of the Lalit, carefree and e-a-s-ylike, little to worry about—a dream song.

Wake up! Get a set of those brushes!

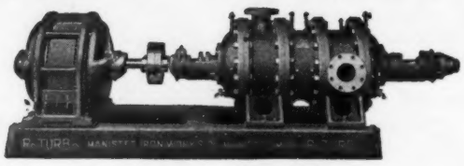
The Morgan Crucible Company

**Main Office and Factory:**
**519 W. 38th Street, New York City**

DISTRICT AGENTS

Lewis & Roth, 13th and Wood Sts., Philadelphia
Electrical Engineering & Mfg. Co.
First National Bank Bldg., Pittsburgh
W. L. Rose Equipment Co.
La Salle Bldg., St. Louis, Mo.
Herzog Electric & Engineering Co.,
150 Steuart St., San Francisco, Cal.
W. R. Hendrey Co., Hoge Bldg., Seattle, Wash.
Charles Farnham, I. W. Hellman Bldg., Los Angeles, Cal.

# R.TURB. PUMPS



B 4 Eight Stage Type—Motor Drive

## Variable Head and Volume

Ordinary Centrifugal Pumps are designed to work only at an exact head. We have solved the problem of operation under varying suction and discharge with our self-regulating feature.

**Wide Range of Duty; No Expensive Delays; No Overload Possible; High and Permanent Efficiency.**

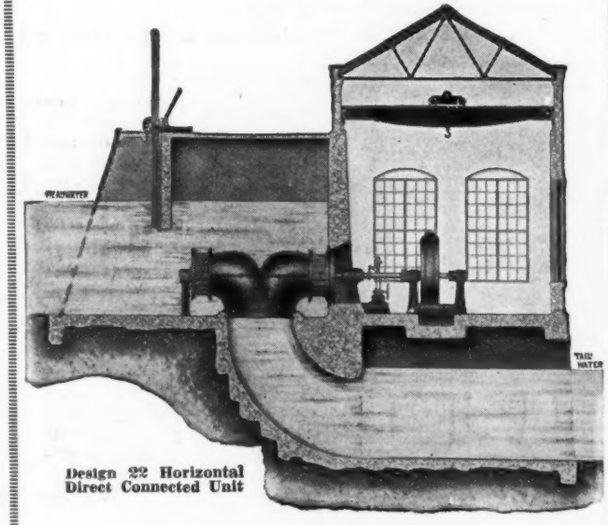
*If you have pumping problems—get our catalog.*

**MANISTEE IRON WORKS CO., Manistee, Mich.**

R.TURB. CENTRIFUGAL PUMPS - ROTARY JET CONDENSERS
MADE BY MANISTEE
AIR PUMPS - CONTINENTAL CHAIN GRATE STOKERS

## LEFFEL TURBINE WATER WHEELS

**HIGH SPEED, HIGH HORSE POWER, HIGH EFFICIENCY**
**VERTICAL AND HORIZONTAL DESIGNS**



Design 22 Horizontal
Direct Connected Unit

*Write for Bulletin 54*

## THE JAMES LEFFEL & CO.

**SPRINGFIELD, OHIO, U. S. A.**

SALES ENGINEERS

L. B. Dow, Inc., 79 Milk Street, Boston, Mass.
H. H. White, 378 Piedmont Ave., Atlanta, Ga.
William Hamilton Co., Ltd., Peterborough, Ont., Canada

# There Is Still Need for Conservation

THE advent of Peace has not lessened the need for careful supervision over consumption of either foodstuffs or material.

The wholehearted cooperation of the entire American people is still required.

As we stood by the Allies in War, we will stand by them in Peace.

Their reconstruction will call for great efforts, and even self-denial on our part.

So don't waste Materials, Food, or Fuel.

And to bring it down to our own business, we can assure you that the consumption of lubricating oils must be guarded as closely as ever.

As ever, Texaco Lubrication Engineering Service will aid you to select the right oil for the right place, and you know that when you have the right oil, you need less.

There is a Texaco Lubricant for every purpose.

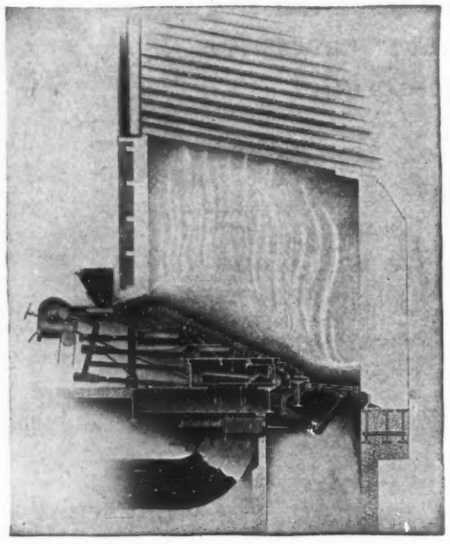
## THE TEXAS COMPANY

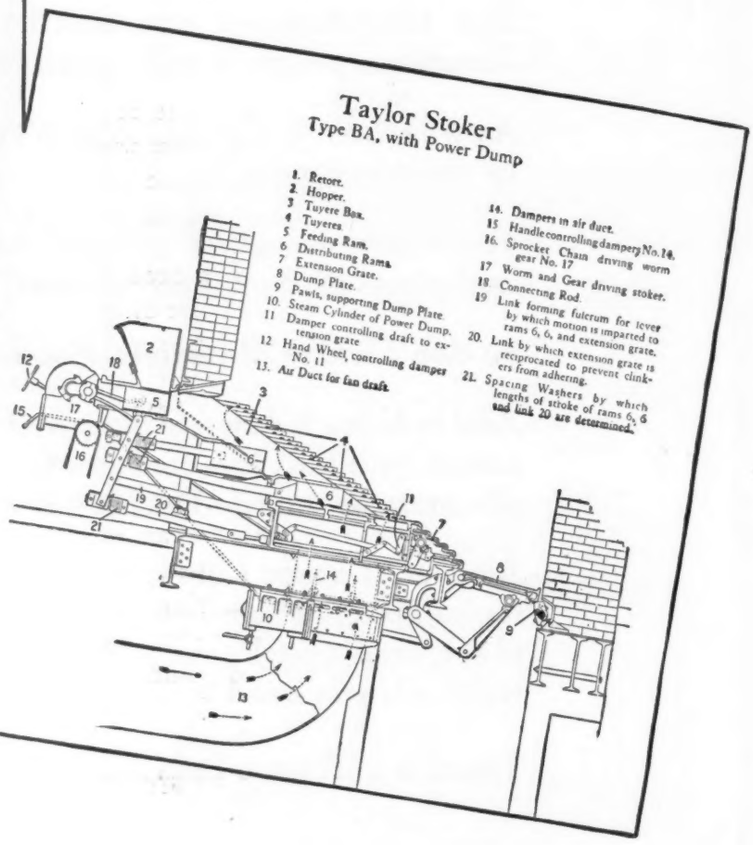
Dept. L-1 17 Battery Place, New York City

New York Chicago Houston

*OFFICES IN PRINCIPAL CITIES*

# The Taylor Stoker




Taylor Stoker
Type BA, with Power Dump
1. Retort.
2. Hopper.
3 Tuyere Box.
4 Tuyeres
5 Feeding Ram.
6 Distributing Rams.
7 Extension Grate.
8 Dump Plate.
9 Pawls, supporting Dump Plate.
10. Steam Cylinder of Power Dump.
11 Damper controlling draft to extension grate
12 Hand Wheel, controlling damper No. 11
13. Air Duct for fan draft.
14. Dampers in air duct.
15 Handle controlling dampers No. 14.
16. Sprocket Chain driving worm gear No. 17
17 Worm and Gear driving stoker.
18 Connecting Rod.
19 Link forming fulcrum for lever by which motion is imparted to rams 6, 6, and extension grate.
20. Link by which extension grate is reciprocated to prevent clinkers from adhering.
21. Spacing Washers by which lengths of stroke of rams 6, 6 and link 20 are determined.

## To Users of

## Taylor Stokers

The war is ended—but not the problems it created. We are due for a period of unprecedented business activities. In addition to continued Government requirements, thousands of power plants in industries partly or wholly dormant through the war will be set going full steam—many new industries will be started. Millions of dollars extended in credit to our Allies will be spent here on the vitally needed materials for reconstruction work. And American plants must manufacture those materials. All this activity will call for the utmost in efficiency from every available power plant.

This series of advertisements has been written to point out the many ways in which the efficiency of the plant depends upon the efficiency of the Taylor Stoker—and to stress the present importance of taking full advantage of the many angles of Taylor Stoker Service. In this connection, we are prepared to render such consulting Engineering Service as lies within our power.

# No. 8 of a series

## The TAYLOR System of Efficient Boiler Firing

# *frees your mind for the larger problems of reconstruction*

## You can think beyond "fuel burning capacity," with your present

# Taylor Stoker Equipment

Records upon records demonstrate beyond the shadow of doubt the ability of the Taylor Stoker to meet *steam demands* with the poorest grade coal—to get heat out of all the combustible elements *despite dirt and slate*—to force the boilers *above rating* with material like Illinois slack.

You know this. It was demonstrated during the war by *your* Taylor Stokers. But have you taken full advantage of this basic Taylor Stoker efficiency?

The quickening pulse of business presents greater power-plant problems than those of *fuel*. Taylor Stokers enable you to concentrate on *those* problems.

To *get* what coal you can and burn it with the help of Taylor Stokers, while the *most important* economy you can effect in your power plant operation, is only one economy. Think it over. Are you, by careful accounting and supervision along other lines, placing *all* your plant operation on the plane of efficiency attained by your Taylor Stokers? NOW is the time to go full steam ahead on reconstruction work-

***Get the rest of your plant in step with Taylor Stoker Performance***

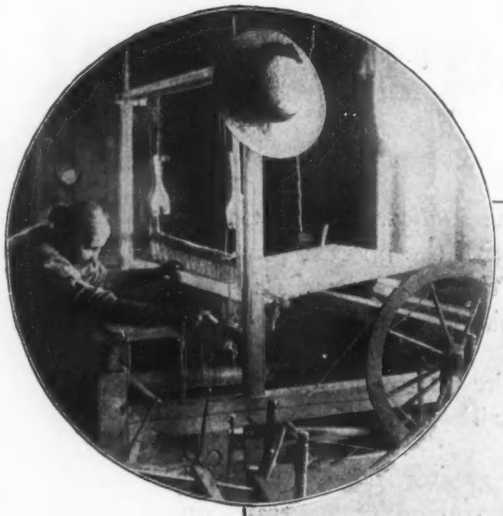
## American Engineering Company

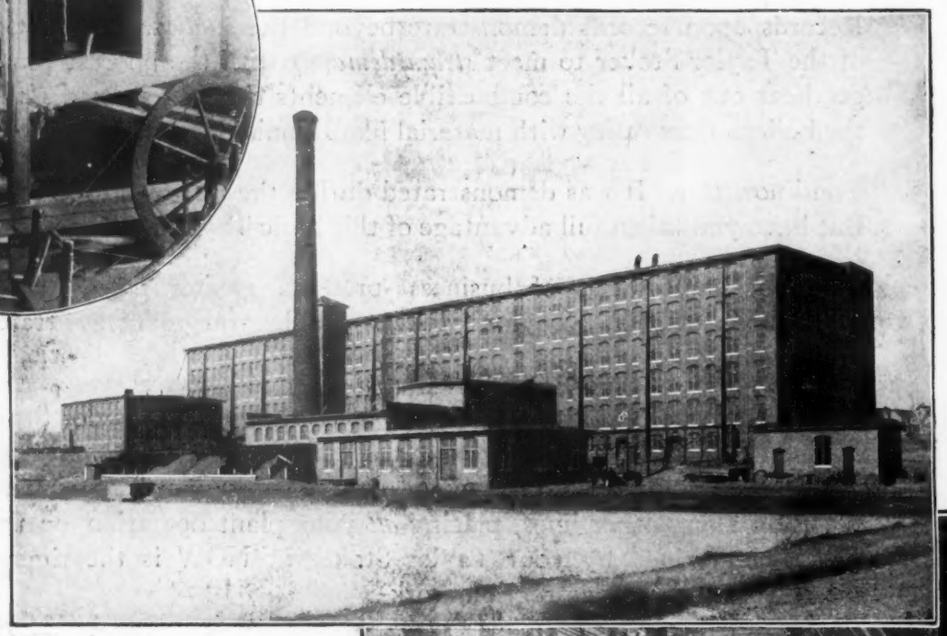
**Philadelphia**

The Taylor Stoker

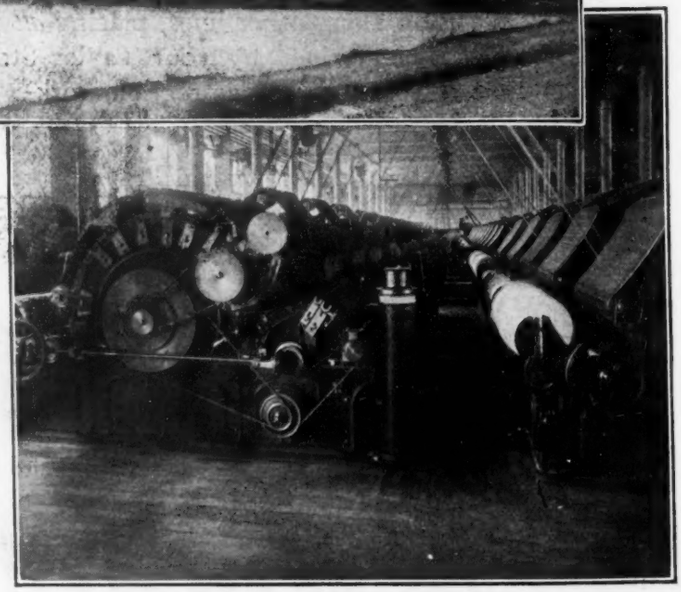
# COT

## The hand loom produced it—





## The modern mill produces it efficiently



# TON

## Hand firing will produce steam—

# TYPE "E" STOKERS

## will do it efficiently

## Combustion Engineering Corporation

11 Broadway, New York City

*Owners and Manufacturers of*

Type "E" Stokers—for Bituminous Coal

The Grieve Grate—Hand-Firing Coxe Stokers—Anthracite Coal and Coke Breeze

PHILADELPHIA, PA. PITTSBURGH, PA. MINNEAPOLIS, MINN. BIRMINGHAM, ALA.
HAZLETON, PA. BOSTON, MASS. CHICAGO, ILL. SEATTLE, WASH.
SALT LAKE CITY, UTAH TAYLOR ENGINEERING CO., VANCOUVER, B. C.

# Balanced Draft

## Theory and Practice

***Theory*** Perfect combustion is the union of fuel (carbon) and exactly the right amount of air (oxygen).

***Practice*** With Balanced Draft the air supply from the fan is increased or decreased in proportion to the load (the fuel burned). This gives the correct amount of air for the required rate of combustion.

***Theory*** The heat resulting from perfect combustion must not suffer dilution from outside air leakage.

***Practice*** With Balanced Draft the furnace pressure is constantly held as near zero as possible. This prevents air leakage through the boiler settings and openings to dilute and reduce the heat.

***Theory*** The heat resulting from perfect combustion must be kept in contact with the heating surfaces as long as there is any usable heat left.

***Practice*** With Balanced Draft the damper is operated to produce the slowest flow of heat and at the same time remove the waste gases without dangerous positive pressure.

***Theory*** To prevent loss, every change in load or fuel bed requires a corresponding adjustment of the air supply and flue damper.

***Practice*** Balanced Draft Regulation is automatic. For every change in load or fuel bed there is instant adjustment.

## Balanced Draft Assures

**Best Combustion**
**Absence of Excess Air**
**Long Contact With Heating Surface**
**High Initial Heat**
**No Heat Dilution**
**Efficient Heat Absorption**

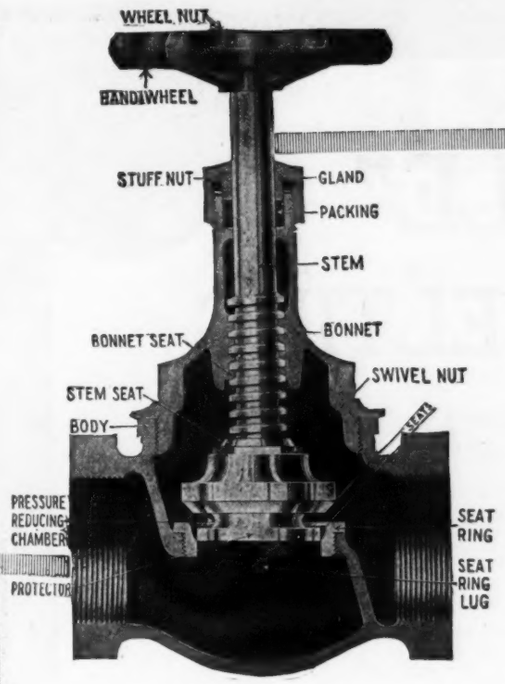
# Balanced Draft

***"A System of Better Combustion"***

## The Engineer Co., 17 Battery Place, New York

***Also Sole Builders of the Turner Baffle Wall—A Permanent and Tight Boiler Baffle***

Boston Buffalo Chicago Cleveland Hazleton, Pa. Kansas City Minneapolis Philadelphia Pittsburgh St. Louis




# —and now comes the Valve Seat Protector

THE most vital need of power plant valves has been a means for preventing wire drawing—thus extending the life of the valve several hundred per cent.

## R-P NO-KUT Valves

### The only Valve with Protected Seats

***Cannot Wire Draw***

## —Because

the valve port is plugged by an extension of the valve disc, called the protector, which holds back the flow until the valve disc is seated or unseated.

Wire drawing is prevented and tightness is maintained many times longer than with any other type of valve, but when necessary, NOKUT Valves are readily reground.

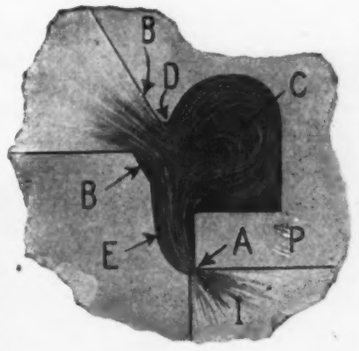
The extra large port opening and the sloping diaphragm walls minimize the pressure drop to such an extent that leading plants are now specifying NOKUT Valves in place of gate valves.

They are regularly furnished in globe, angle, cross, check and blow-off, patterns, either screwed or flanged, and made of brass, cast-iron, semi-steel or steel bodies.

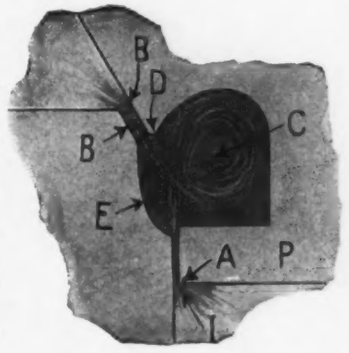
NOKUT Valves stay tight at least twice as long as any other make designed for the same service. If they don't make good—we will.

In the meantime why not learn more about NOKUT Valves by asking for our Bulletin L-100. Write for a copy.

## The NO-KUT Expansion Chamber




At the instant of closing or opening the NOKUT Valve, the annular expansion chamber between the seats "B" and the protector "P" serves to deflect the flow and cause eddies which destroy the force of the steam jet across the seating surfaces at "B."




At the instant when the protector "P" leaves or enters the valve port, observe that the area of the annular opening at "B" is many times that at "A," which greatly reduces the velocity of the jet across the seating surfaces.

# THE RICHARDSON-PHENIX CO.

NOKUT VALVE DEPARTMENT

WORKS-127 RESERVOIR AVE. MILWAUKEE, WIS.

V-21

# "TURTLE"
# LEATHER BELTING

The mere fact that **"Turtle"** was the first waterproof leather belt made—the original of all in the waterproof class—would not mean so much, were it not also true that it was a product of Hoyt—who, even in 1860 when **"Turtle"** was introduced, had for 25 years been recognized as the Master Belt Maker. When you buy **"Turtle"** for use in water, steam, moisture, oil, or acid fumes, or even dry drives, you are buying a belt that embodies all that is known—and the best that is known—about waterproof belt making.

EDW. R. LADEW CO., INC.
GLEN COVE, NEW YORK, U.S.A.
Since 1835

# TERRY TURBINE DRIVE

## *Back Again*

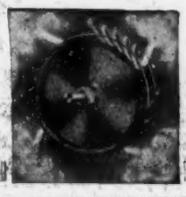
As the U. S. Navy needed almost our entire output during the war, we often thought it best to refuse commercial orders.

Now that the war is over, we are proud of our record, that:

**1. Not a single TERRY TURBINE was rejected for any cause.**

**2. When a TERRY TURBINE was needed, it was there on time.**

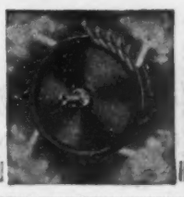
We are now back in the commercial field with increased facilities and short shipments.



**The Terry Steam Turbine Co.**

**Terry Square, Hartford, Conn.**

T-568



# Williams Coal Crushers

## For Power Plants

## *Why Crush Coal At The Plant?*

Your stokers represent an investment that overshadows the cost of the equipment that will make them a *sound* investment. You must supply stokers with properly sized coal to secure the results of which they are actually capable.

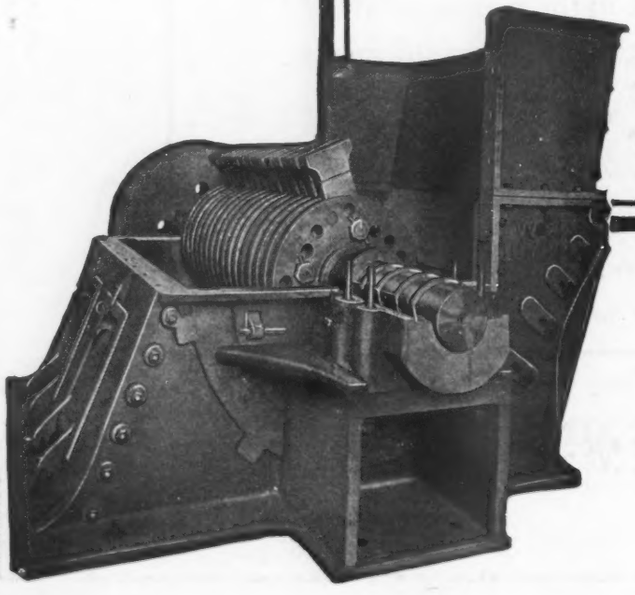
Williams Crushers reduce run-of-mine and lump coal to the correct size for use in stokers and the coal produced contains a far lower percentage of fines than will be found in slack and screenings coming direct from the mines.

Stokers supplied with coal free from fines and degradation give better and more economical results.

Williams Crushers are adaptable to all plant conditions and are adjustable to practically all sizes of crushing.

All Williams Crushers are provided with a metal trap which gathers in a pocket, all stray pieces of iron. This prevents damage to the crusher. It is a feature found only in Williams Crushers.

***Bulletin No. 92 contains complete description.***



**The Williams Patent Crusher and Pulverizer Co.**
***General Sales Department***
**37 W. Van Buren St. Chicago**
**Plant: St. Louis**
**67 Second St., San Francisco**

**WHY not give us an opportunity to quote on your requirements for high grade screw machine products $\frac{1}{8}$-in. to $3\frac{3}{4}$-in. capacity, light and heavy machine work, stampings and electro-galvanizing? Our facilities for QUANTITY PRODUCTION are at your disposal.**

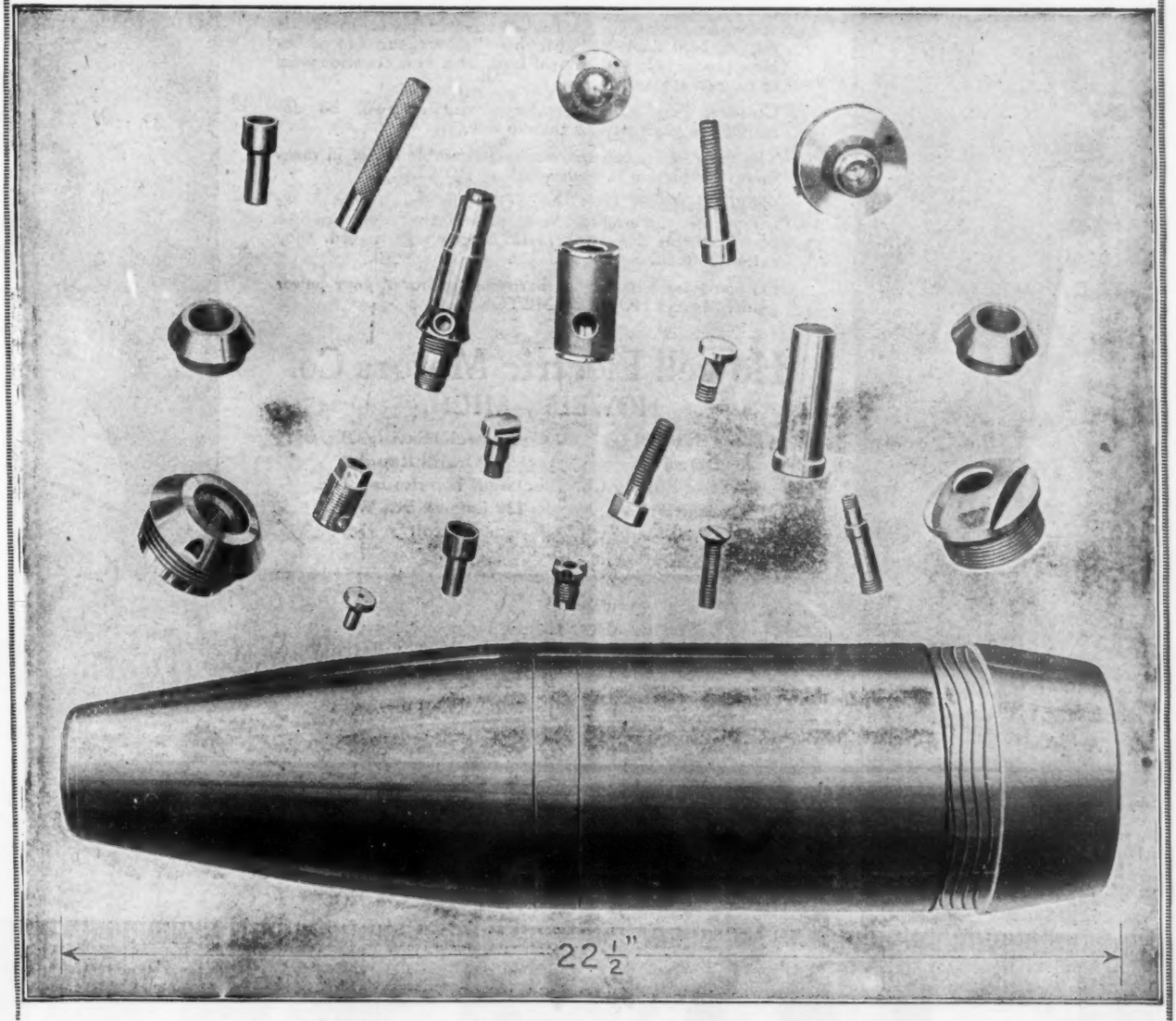
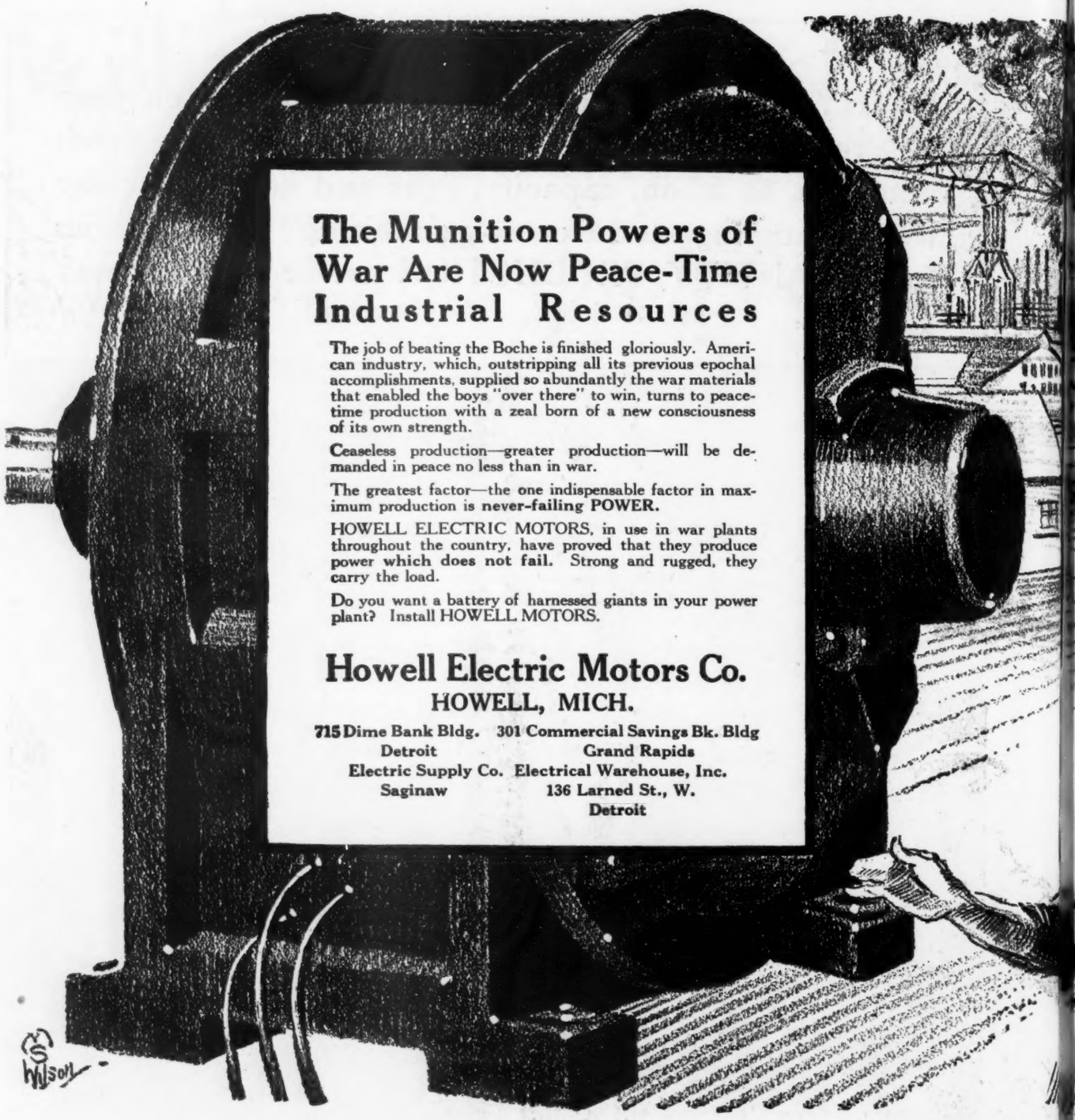



ILLUSTRATION OF SOME OF THE WORK WE HAVE BEEN DOING RECENTLY

*For Accuracy and Prompt Delivery, Write*

**INTERNATIONAL ARMS & FUZE CO., INC.**

*Factories:* BLOOMFIELD, NEW JERSEY MONTREAL, CANADA



# The Munition Powers of War Are Now Peace-Time Industrial Resources

The job of beating the Boche is finished gloriously. American industry, which, outstripping all its previous epochal accomplishments, supplied so abundantly the war materials that enabled the boys "over there" to win, turns to peace-time production with a zeal born of a new consciousness of its own strength.

Ceaseless production—greater production—will be demanded in peace no less than in war.

The greatest factor—the one indispensable factor in maximum production is **never-failing POWER.**

HOWELL ELECTRIC MOTORS, in use in war plants throughout the country, have proved that they produce power which does not fail. Strong and rugged, they carry the load.

Do you want a battery of harnessed giants in your power plant? Install HOWELL MOTORS.

## Howell Electric Motors Co.

HOWELL, MICH.

**715 Dime Bank Bldg.**
**Detroit**
**Electric Supply Co.**
**Saginaw**

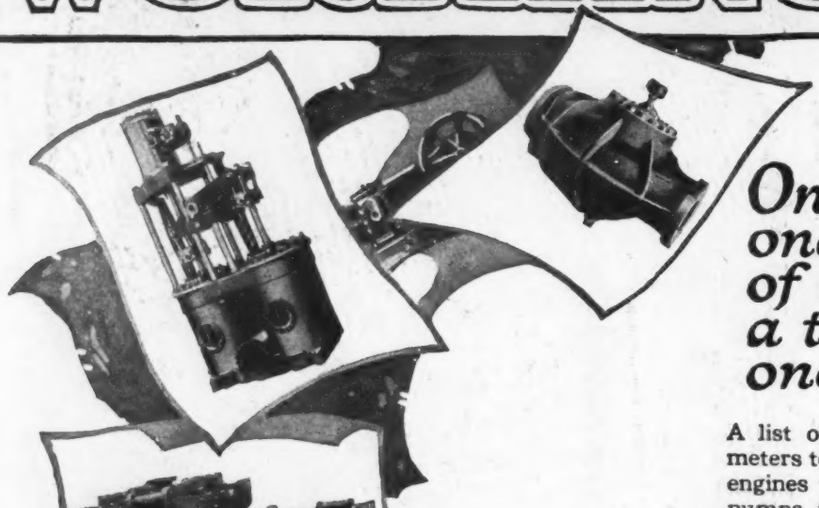
**301 Commercial Savings Bk. Bldg**
**Grand Rapids**
**Electrical Warehouse, Inc.**
**136 Larned St., W.**
**Detroit**

# HOWELL ELE

DRIVING POWER

# ELECTRIC MOTORS
## FOR ALL PURPOSES

# WORTHINGTON



## *One name, one standard of excellence,— a thousand and one products*

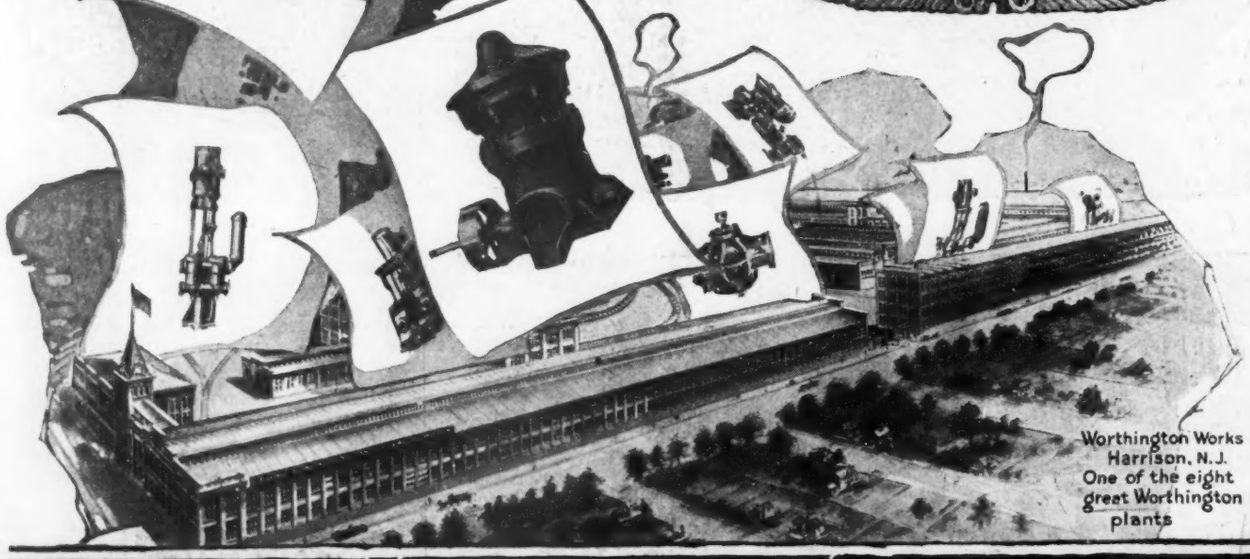
A list of products ranging from water meters to great pumping engines, from oil engines and gas engines to centrifugal pumps, from vacuum pumps to air compressors, from domestic lighting or water supply units to tractors, from mining to cement-making machinery and mammoth rock crushers—

A list of products which serve alike the city dweller and the farmer, the manufacturer and the miner, the marine engineer and the construction engineer—

And facilities unequalled in size and completeness for the production and distribution of this great list of products—

These are some of the meanings of the Worthington name to American industry and to the American people.

**Worthington Pump and Machinery Corporation**
115 Broadway, New York City
*Branch Offices in 24 Large Cities*



Worthington Works
Harrison, N. J.
One of the eight great Worthington plants

**LARGEST MAKERS OF PUMPING AND MINING MACHINERY**

See page 21
January
Ladies Home
Journal

VISUALIZE in full color, if you can, this photographic reproduction of our January advertising in Ladies' Home Journal.

Its exquisite beauty of line and color will make a compelling appeal to the discerning women of this country.

Maxfield Parrish, the designer, master of color and light, has here expressed artificial light with a subtlety and vividness that his brush alone commands.

Popular imagination will be caught by this living tribute to one of our great sources of light, the Edison Mazda Lamp.

All appropriate mediums of publicity are being utilized to give the world a true appreciation of its man-made light.

For instance, this Maxfield Parrish painting has been reproduced as our 1919 calendar, as a magazine advertisement, as a large poster for window display, and in several other ways, all to increase the sale of Edison Mazda Lamps and to add to the prestige of those who sell them.

—and even the Spirit of the Night,
Lured from her far and dusky halls,
Follows the gleam that falls
Across her throne,
And comes to wonder and admire
How man has conquered light and fire
And made their radiance his own.

# EDISON
# MAZDA

47D-85

GENERAL ELECTRIC COMPANY

# *"They build over 500,000 motors a year—could there be any stronger recommendation for a MOTOR?"*

## *The man in your town who knows Motors*

EVERY city and large town has its G-E Motor Agency.

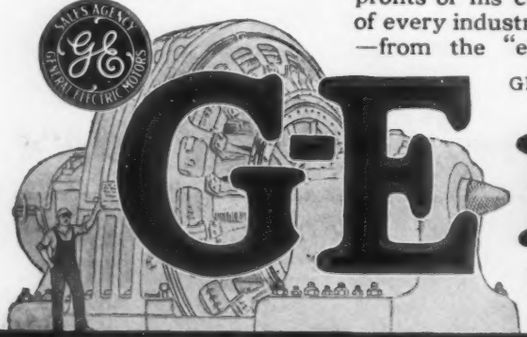
You can depend on the G-E Motor Agency man's thorough knowledge of the application of electric power. He does not rely on guesswork—he *knows* horse-power ratings, types of motors and the correct control.

The business of the G-E Motor Agency man is to conserve power, increase production and add to the profits of his customers. The door of every industry in his community—from the "electric shoe repair shop" to the big manufacturing plant—is wide open to him for what he knows and the way he serves. And not the least of his assets is the company behind him, building more than 500,000 motors a year, and whose foremost engineers he can freely consult.

Call on your local G-E Motor Agency man—he can meet your power needs either by the installation of new motors or by rearranging motors and machines without necessitating the purchase of additional equipment.

Look for this sign—
*It is displayed by every G-E Motor Agency*

GENERAL ELECTRIC COMPANY, Schenectady, N. Y.




# G-E motors

From the Mightiest to the Tiniest

GENERAL ELECTRIC COMPANY

*The bulk of the best electric motor business in any community usually goes into the door where this sign hangs.*

SALES AGENCY
GE
GENERAL ELECTRIC MOTORS

*The man in your town who buys Motors*

ORDINARILY, in his purchases, he is actuated by preference, which, broadly analyzed, is the sum of his impressions and his experience.

If he is an old customer, he purchases largely on experience or performance.

If he is a new customer, he buys on impressions—impressions of others' experience—impressions gained via the personality of the salesman who calls on him—impressions graven on his mind over a short or long period by advertising.

Ten to fifteen million people—the whole magazine-reading public—are constantly getting impressions of G-E Motors, from advertisements like that on the opposite page, which appears in Collier's Weekly of Nov. 30th, the Saturday Evening Post of Dec. 28th, American Magazine for January and elsewhere.

The cumulative effect of G-E Motor advertising on the man who buys motors in your town cuts down to the minimum the selling resistance of G-E Motors, particularly if the G-E Motor Agency is thoroughly identified in its community with the sale of G-E Motors.

GENERAL ELECTRIC COMPANY, Schenectady, N. Y.

G-E motors

From the Mightiest to the Tiniest

GENERAL ELECTRIC COMPANY

# For Constant and Adjustable Speed Duty

Type T Reliance Motors are designed for machines requiring either a constant speed drive or a variation in speed to obtain maximum output.

Speed adjustments are obtained with the various types of controllers by fieid resistance control. Speed ranges up to 1 to 4 are obtainable by this method.

Type T motors are built to stand up under the hardest day in and day out service. They embody the practical expe-rience of 35 electrical engineers in the big steel mills and machine shops.

The story of how they were designed and how they are built should interest the man who wants better motors. It is told in Bulletin 2014 with 39 illustrations.

**Reliance Electric & Engineering Co.**

1046 Ivanhoe Road, Cleveland, O.

Branches: New York, Philadelphia, Pittsburgh, Chicago

Type T Heavy Duty RELIANCE MOTORS Direct Current

# WHAT AND WHERE TO BUY

## Equipment, Apparatus and Supplies Used by the Electrical Industry with Names of Manufacturers and Distributors

**Air Compressors.**
Allis-Chalmers Mfg. Co.
General Electric Co.
Worthington P. & M. Corp.

**Air Washers and Coolers.**
Spray Engrg. Co.

**Aluminum.**
Aluminum Co. of America.

**Ammeters, Voltmeters.**
(See Instruments, Electrical).

**Anchors, Guy.**
Crouse-Hinds Co.
Hubbard & Co.
Matthews & Bro., Inc., W. N.

**Annunciators**
Ostrander Co., W. R.

**Armature Disk and Segment**
Bliss Co., E. W.

**Armature Repair Machinery**
Electric Service Supplies Co.

**Asbestos Lumber.**
Johns-Manville Co., H. W.

**Batteries, Dry Cell.**
Manhattan Elec'l Supply Co.
Western Elec. Co.

**Batteries, Storage.**
Edison Storage Battery Co.
Electric Storage Battery Co.

**Battery Charging Apparatus.**
Cutler-Hammer Mfg. Co.
General Elec. Co.
Lincoln Elec. Co.
Weshe Electric Co., B. A.

**Bearings, Ball.**
Norma Co. of America.
S. K. F. Ball Bearing Co.

**Bells**
Ostrander Co., W. R.

**Belting Leather**
Ladew Co., Inc., Edw. R.

**Blowers, Fan**
Engineer Co., The

**Blowers, Steam Driven.**
Green Fuel Economizer Co.
Terry Steam Turbine Co.

**Boiler Baffles**
Engineer Co., The

**Boilers, Steam.**
Babcock & Wilcox Co.
Bigelow Co.
Edge Moor Iron Co.

**Bolts, Expansion.**
Hubbard & Co.

**Bond Testers.**
Roller-Smith Co.

**Books, Technical.**
McGraw-Hill Company, Inc.

**Boosters.**
Crocker-Wheeler Co.
General Electric Co.
Ridgway Dynamo & Eng. Co.
Triumph Electric Co.
Weshe Elec. Co., B. A.
Westinghouse Elec. & Mfg. Co.

**Boxes, Fuse.**
Crouse-Hinds Co.
G. & W. Electric Specialty Co.
General Electric Co.
Johns-Manville Co., H. W.
Matthews & Bro., Inc., W. N.
Metropolitan Eng'g Co.
Square D. Co.

**Boxes, Junction and Outlet.**
Crouse-Hinds Co.
D. & W. Fuse Co.
G. & W. Electric Specialty Co.
General Electric Co.
National Metal Molding Co.
Sprague Electric Works.

**Boxes, Meter and Service.**
Crouse-Hinds Co.
General Elec. Co.
Johns-Manville Co., H. W.
Metropolitan Eng'g Co.

**Brackets and Pins, Metal.**
Hubbard & Co.
Pittsburgh Transformer Co.

**Brushes, Dynamo.**
Jeandron, W. J.
Morgan Crucible Co., Ltd.
National Carbon Co.
United States Graphite Co.

**Buckets, Excavating, Motor Driven.**
Hayward Co.

**Buildings, Steel.**
Blaw-Knox Co.
Milliken Bros. Mfg. Co.

**Bushings.**
Crouse-Hinds Co.
National Metal Molding Co.

**Cabinets, Panel Board**
Crouse-Hinds Co.

**Cable End Bells**
Electrical Engineers Equipment Co.
G. & W. Electric Specialty Co.

**Cable Racks.**
Efficiency Electric Co.
Hubbard & Co.
Metropolitan Eng'g Co.

**Cabling Machinery.**
American Ins. Machinery Co.
New England Butt Co.

**Carbon Brushes.**
Jeandron, W. J.
Morgan Crucible Co., Ltd.
National Carbon Co.
United States Graphite Co.

**Cars, Coal & Ash Handling.**
Easton Car & Const. Co.

**Castings**
Triumph Electric Co.

**Castings, Die.**
Doehler Die-Casting Co.

**Chains, Silent Driving**
Morse Chain Co.

**Chains, Silent Power Transmission**
Morse Chain Co.

**Circle Shears for Armature Disks and Segments**
Bliss Co., E. W.

**Circuit Breakers.**
Auto-Reclosing Circuit Breaker Co.
Condit Electrical Mfg. Co.
General Electric Co.
Industrial Controller Co.
Palmer Elec. & Mfg. Co.
Roller-Smith Co.
Sangamo Elec. Co.
Sundh Elec. Co.
Ward Leonard Elec. Co.
Westinghouse Elec. & Mfg. Co.

**Clamps, Cable Supporting.**
Matthews & Bro., Inc., W. N.

**Clamps, Ground Connections.**
Condit Electrical Mfg. Co.
General Electric Co.

**Clamps, Guy.**
Hubbard & Co.
Matthews & Bro., Inc., W. N.

**Clamps, Insulator.**
Efficiency Electric Co.
Electrical Engineers Equipment Co.

**Cleats.**
Blake Signal & Mfg. Co.
Imperial Porcelain Works.
National Metal Molding Co.
Thomas & Sons Co., R.

**Clips, Cable**
Condit Electrical Mfg. Co.
Hubbard & Co.

**Clips, Testing**
Mueller & Co., R. S.

**Clusters**
Hubbell, Inc., Harvey
Federal Sign System

**Clutches, Magnetic.**
Cutler-Hammer Mfg. Co.

**Coal and Ash Handling Machinery.**
Godfrey, John F.
Hayward Co.

**Coal Crushers and Pulverizers**
Williams Patent Crusher & Pulverizer Co.

**Coil Winding Tools**
Electric Service Supplies Co.

**Coils, Armature, Field**
D & W Fuse Co.
Independent Lamp & Wire Co.

**Coils, Choke.**
Delta Star Elec. Co.
General Electric Co.

**Commutator Stones.**
Ideal Commutator Dresser Co.

**Commutators.**
Cameron Electric Mfg. Co.

**Compounds, Commutator.**
McLennan Co., K.

**Condensers.**
Manistee Iron Wks. Co.
Worthington P. & M. Corp.

**Conduit Bends.**
Fibre Conduit Co.

**Conduit Fittings.**
Crouse-Hinds Co.
Fibre Conduit Co.
Sprague Electric Works.

**Conduits, Interior.**
American Circular Loom Co.
National Metal Molding Co.
Sprague Electric Works.

**Conduits, Underground.**
Fibre Conduit Co.
Johns-Manville Co., H. W.

**Connectors, Solderless.**
Westinghouse Elec. & Mfg. Co.

**Connectors and Terminals.**
Electrical Engineers Equipment Co.
Westinghouse Elec. & Mfg. Co.

**Contact Rail Material**
Electric Service Supplies Co.

**Controllers, Motor.**
Cutler-Hammer Mfg. Co.
Electric Controller & Mfg. Co.
General Electric Co.
Industrial Controller Co.
Monitor Controller Co.
Sundh Electric Co.
Ward Leonard Elec. Co.
Westinghouse Elec. & Mfg. Co.

**Conveying Machinery (Coal, Ashes, Etc.)**
American Bridge Co.
Green Engineering Co.
Hunt Co., C. W.

**Cooling Ponds, Spray.**
Spray Engrg. Co.

**Cord Adjusters.**
American Vul. Fibre Co.

**Cord, Arc Lamp.**
Samson Cordage Works.

**Cord, Flexible.**
Belden Mfg. Co.
Lowell Insulated Wire Co.
Rome Wire Co.

**Cord, Trolley.**
Samson Cordage Works.

**Couplings, Flexible.**
Smith-Serrell Co., Inc.

**Crane Motors.**
Sprague Electric Works.
Triumph Electric Co.
Westinghouse Elec. & Mfg. Co.

**Cranes, Traveling.**
American Bridge Co.
Maris Bros.

**Cross Arms.**
American Bridge Co.
Hubbard & Co.
Thomas & Sons Co., R.
Western Electric Co.

**Cutting Dies**
Bliss Co., E. W.

**Cutouts.**
Condit Electrical Mfg. Co.
D & W Fuse Co.
G. & W. Electric Specialty Co.
General Elec. Co.
Matthews & Bro., Inc., W. N.
Metropolitan Eng'g. Co.

**Dies**
American Metal Works

**Draft, Mechanical.**
Engineer Co., The
Green Fuel Economizer Co.

**Drills, Brick.**
Hubbard & Co.

**Dynamos and Motors.**
Allis-Chalmers Mfg. Co.
Burke Elec. Co.
Century Electric Co.
Crocker-Wheeler Co.
Diehl Mfg. Co.
Electric Machinery Co.
Electro Dynamic Co.
Emerson Electric Mfg. Co.
General Electric Co.
Gregory Electric Co.
Howell Electric Motors Co.
Ideal Electric Mfg. Co.
Kimble Electric Co.
Lincoln Electric Co.
Mechanical Appliance Co.
Northwestern Electric Co.
Reliance Elec. & Eng'g. Co.
Ridgway Dynamo & Engine Co.
Robbins & Myers Co.
Roth Bros. & Co.
Sprague Electric Works.
Triumph Electric Co.
Wagner Electric Mfg. Co.
Weshe Electric Co., B. A.
Western Elec. Co.
Westinghouse Elec. & Mfg. Co.

**Ebony Asbestos Wood (Switchboard Mat'l).**
Johns-Manville Co., H. W.

**Economizers, Fuel.**
Green Fuel Economizer Co.

**Electromagnets**
Acme Wire Co.
Elec. Controller & Mfg. Co.
Ohio Elec. & Controller Co.
Ward Leonard Elec. Co.

**Engineers, Consulting and Contracting.**
(See also Directory of Engineers.)

**Engines, Gas and Gasoline.**
Allis-Chalmers Mfg. Co.
Worthington P. & M. Corp.

**Engines, Oil.**
Chicago Pneumatic Tool Co.
McIntosh & Seymour Corp.
Worthington P. & M. Corp.

**Engines, Steam.**
Allis-Chalmers Mfg. Co.
Ridgway Dynamo & Eng. Co.

**Excavating Machinery, Motor-Driven.**
Hayward Co.

**Experimental Apparatus.**
Biddle, James G.
Leeds & Northrup Co.
Roller-Smith Co.

**Fan Motors.**
Century Elec. Co.
Diehl Mfg. Co.
Emerson Electric Mfg. Co.
General Elec. Co.
Robbins & Myers Co.
Sprague Electric Works.
Western Elec. Co.

**Fans (Exhaust and Ventilating)**
Crocker-Wheeler Co.
Diehl Mfg. Co.
Emerson Elec. Co.
General Elec. Co.
Green Fuel Economizer Co.
Kimble Elec. Co.
Mechanical Appliance Co.
Robbins & Myers Co.
Sprague Electric Works.
Westinghouse Elec. & Mfg. Co.

**Fans, Turbine Driven.**
Terry Steam Turbine Co.

**Fault Finders, Cable.**
Matthews & Bro., Inc., W. N.

**Fibre.**
American Vul. Fibre Co.
Continental Fibre Co.
Diamond State Fibre Co.
Fibre Conduit Co.

**Field Coils, Pads**
United States Rubber Co.

**Filters, Oil.**
Richardson-Phenix Co.

**Filters, Water**
Scaife & Sons, W. B.

**Financial**
Coal & Iron National Bank.

**Fire Alarms**
Ostrander & Co., W. R.

**Fire Extinguishers.**
Johns-Manville Co., H. W.

**Fixture Holders, Adjustable.**
Matthews & Bro., Inc., W. N.

**Fixtures, Electric and Gas.**
Faries Mfg. Co.
Federal Sign System

**Flashers.**
Campbell Electric Co.

**Friction Tape and Cloths.**
Johns-Manville Co., H. W.
United States Rubber Co.

**Furnaces, Electric.**
Pittsburgh Furnace Co.

**Fuses.**
Condit Electrical Mfg. Co.
D. & W. Fuse Co.
Daum, A. F.
Economy Fuse & Mfg. Co.
General Electric Co.
Johns-Manville Co., H. W.
Metropolitan Eng'g. Co.
Railway & Industrial Eng. Co.
Schweitzer & Conrad, Inc.
Western Elec. Co.

**Fuses, Refillable.**
Daum, A. F.
Economy Fuse & Mfg. Co.
Federal Sign System

**Gauges, Recording.**
Bristol Co.

# IDEAL MOTORS

## The IDEAL WAY To Solve Your Power Problems

Saying Ideal motors provide the **ideal** drive is more than a mere phrase. It means getting a motor on the job that is designed and built for the work it is to do—a motor that makes good every time—and **all** the time.

During the war our entire resources were devoted to supplying Ideal Motors to war plants. Now, however, we are rapidly getting back on a peace basis, and we are ready to apply "Ideal Drive" to the great work of reconstruction.

Our engineers are at your service—they will help to solve your power problems "The Ideal Way." Write for Bulletins and full information.

THE IDEAL E&M POWER APPARATUS

**The IDEAL ELECTRIC & Manufacturing Co., Mansfield, Ohio**

*Branches and Agencies in All Principal Cities*

THE IDEAL E&M POWER APPARATUS

## READY FOR RECONSTRUCTION

# WHAT AND WHERE TO BUY

**Foxboro Co., The.**

**Gearing, Silent Flexible**
Morse Chain Co.
Yarnall-Waring Co.

**Gears.**
Diamond State Fibre Co.
General Elec. Co.
New Process Gear Corp.

**Gears, Herringbone.**
Poole Eng'g. & Mach. Co.

**Gears, Reduction.**
Poole Eng'g. & Mach. Co.

**Globes, Shades, Etc.**
Faries Mfg. Co.

**Grounds, Etc.**
Paragon Elec. Co.

**Ground Rods**
Page Steel & Wire Co.

**Guards, Incandescent Lamp.**
Hubbell, Inc., Harvey
Matthews & Bro., Inc., W. N.
McGill Mfg. Co.

**Hair Driers.**
Shelton Elec. Co.

**Hangers, Cable**
Condit Electrical Mfg. Co.
Efficiency Electric Co.
Hubbard & Co.

**Head Gates**
American Bridge Co.

**Headlights, Arc and Incandescent**
Crouse-Hinds Co.

**Heating Devices, Electric.**
General Electric Co.
Western Elec. Co.
Westinghouse Elec. & Mfg. Co.

**Heating, Steam.**
American District Steam Co.

**Hoists, Electrical and Steam.**
Allis-Chalmers Mfg. Co.
Maris Bros.
Sprague Electric Works.

**Indicators, Sight Flow.**
Richardson-Phenix Co.

**Indicators, Speed.**
Biddle, James G.
Roller-Smith Co.

**Industrial Railways and Cars**
Easton Car & Const. Co.
Hunt Co., C. W.

**Instrument Transformers.**
General Elec. Co.
Weston Electrical Instrument Co.

**Instruments, Electrical.**
**Graphic.**
Biddle, James G.
Bristol, Co.
General Electric Co.
Sangamo Elec. Co.
Westinghouse Elec. & Mfg. Co.
**Indicating.**
General Electric Co.
Roller-Smith Co.
Wagner Elec. Mfg. Co.
Westinghouse Elec. & Mfg. Co.
Weston Electrical Instrument Co.
**Integrating.**
Biddle, James G.
Federal Sign System
General Electric Co.
Roller-Smith Co.
Sangamo Electric Co.
Westinghouse Elec. & Mfg. Co.
**Repairing and Testing.**
Illinois Testing Laboratories
**Scientific and Testing.**
Biddle, James G.
General Electric Co.
Leeds & Northrup Co.
Metropolitan Eng'g. Co.

**Insulating Cement.**
Condensite Co. of America.
United States Rubber Co.

**Insulating Machinery.**
American Ins. Machinery Co.
New England Butt Co.

**Insulating Material.**
**China and Porcelain.**
Imperial Porcelain Works.
Lapp Insulator Co., Inc.
Locke Insulator Mfg. Co.
Parker & Son, J. H.
Pittsburg H. V. Ins. Co.
Thomas & Sons Co., R.
**Compounds, Paints and Varnishes**
Condensite Co. of America.
Electric Cable Co.
Garfield Mfg. Co.
General Bakelite Co.
Irvington Varnish & Ins. Co.
Mitchell-Rand Mfg. Co.
Packard Elec. Co.
Redmanol Chemical Products Co.
United States Rubber Co.
**Composition, Cloth and Paper**
Irvington Varnish & Ins. Co.
United States Rubber Co.
**Fibre.**
Amer. Vulcanized Fibre Co.
Continental Fibre Co.
Diamond State Fibre Co.
**Lava.**
Steward Mfg. Co., D. M.
**Mica.**
Burleson Mica Co., J. E.
Munsell & Co., Engene.
**Silk.**
Irvington Varnish & Ins. Co.
Ryle & Co., Wm.
**Tape.**
Mitchell-Rand Mfg. Co.
New York Insulated Wire Co.
Okonite Co., The
Packard Elec. Co.
Standard Woven Fabric Co.
United States Rubber Co.

**Insulating Paper.**
Diamond State Fibre Co.
Irvington Varnish & Ins. Co.
Johns-Manville Co., H. W.

**Insulators.**
**China, Porcelain and Composition.**
Imperial Porcelain Works.
Lapp Insulator Co., Inc.
Locke Insulator Mfg. Co.
Pittsburg High Volt Ins. Co.
Thomas & Sons Co., R.
**Glass**
Brookfield Glass Co.
Lapp Insulator Co., Inc.
Locke Insulator Mfg. Co.

**Insulator Pins.**
Hubbard & Co.
Thomas & Sons Co., R.

**Insurance, Fire Liability**
Utilities Indemnity & Fire Exchanges

**Lamp Guards.**
Hubbell, Inc., Harvey.
Matthews & Bros., Inc., W. N.

**Lamp Replacers.**
Matthews & Bro., Inc., W. N.

**Lamps, Arc.**
General Electric Co.
Westinghouse Elec. & Mfg. Co.

**Lamps, Flaming Arc.**
General Electric Co.
Westinghouse Elec. & Mfg. Co.

**Lamps, Incandescent.**
Boston Economy Lamp Div.
Chicago Elec. Lamp Co.
Consolidated Elec. Lamp Co.
Edison Lamp Works.
General Electric Co.
Hygrade Lamp Co.
Independent Lamp & Wire Co.
Western Elec. Co.
Whitelite Elec. Co.

**Lamps, Miniature.**
Beacon Electric Works.
General Electric Co.

**Lamps, Portable.**
Faries Mfg. Co.

**Lava.**
**(See Insulating Material, Lava.)**

**Lightning Arresters.**
Delta Star Elec. Co.
Electric Service Supplies Co.
Electrical Engineers Equipment Co.
General Electric Co.
Hubbard & Co.
Lewis & Roth Corp.
Railway & Industrial Eng. Co.
Schweitzer & Conrad, Inc.
Westinghouse Elec. & Mfg. Co.

**Line Material.**
Anderson Mfg. Co., A. & J. M.
Archbold-Brady Co.
Electric Service Supplies Co.
G. & W. Electric Specialty Co.
General Electric Co.
Hubbard & Co.
Johns-Manville Co., H. W.
Western Elec. Co.
Westinghouse Elec. & Mfg. Co.

**Linemen's Shields.**
Matthews & Bro., Inc., W. N.

**Linemen's Tools.**
**(See Tools, Linemen.)**

**Lubricating Oils.**
Texas Co.

**Lubrication Engineers.**
Richardson-Phenix Co.

**Lubricators.**
Richardson-Phenix Co.

**Machines, Armature Notching.**
Ferracute Machine Co.

**Machines, Pipe Bending**
American Pipe Bending Machine Co.

**Magnet Wire.**
Acme Wire Co.
American Brass Co.
American Electrical Works.
American Steel & Wire Co.
Ansonia Elec. Co.
Belden Mfg. Co.
Benedict & Burnham Mfg. Co.
D & W Fuse Co.
Hazard Mfg. Co.
Independent Lamp & Wire Co.
Massachusetts Elec. Mfg. Co.
Page Steel & Wire Co.
Roebling's Sons Co., J. A.
Rome Wire Co.
Western Elec. Co.

**Magnets.**
Acme Wire Co.
Cutler-Hammer Mfg. Co.

**Magnets, Lifting.**
Cutler-Hammer Mfg. Co.
Elec. Controller & Mfg. Co.
Ohio Elec. & Controller Co.

**Mechanical Stokers.**
Amer. Engrg. Co.
Combustion Engineering Co.
Riley Stoker Co., Ltd., Sanford.

**Metal Work, Drawn and Stamped.**
American Metal Works.
Patten-MacGuyer Co.
Risdon Tool & Mach. Co.

**Meter Testers**
States Company, The

**Meters, Flow.**
General Elec. Co.
Spray Engineering Co.

**Meters, Hot Water**
Worthington Pump & Mach'y Corp.

**Mica.**
Burleson Mica Co., J. E.
Munsell & Co., Eugene.

**Mining Machinery.**
Allis-Chalmers Mfg. Co.
Worthington Pump & Mach'y Corp.

**Molded Insulation.**
Condensite Co. of America.
Garfield Mfg. Co.
General Bakelite Co.
Johns-Manville Co., H. W.
Northern Industrial Chemical Co.
Redmanol Chemical Products Co.

**Molded Parts.**
Belden Mfg. Co.
Condensite Co. of America.

**Molding, Metal.**
National Metal Molding Co.

**Motors.**
**(See Dynamos & Motors.)**

**Novelties, Electric**
Beacon Electric Works.

**Nozzles, Spray.**
Spray Engineering Co.

**Oils, Lubricating**
Texas Co.

**Oil, Transformer.**
Texas Co.

**Oilers, Telescope.**
Richardson-Phenix Co.

**Oiling Systems, Cutting.**
Richardson-Phenix Co.

**Oiling Systems, Hydro-electric.**
Richardson-Phenix Co.

**Oiling Systems, Sight Feed.**
Richardson-Phenix Co.

**Oiling Systems, Steam Turbine**
Richardson-Phenix Co.

**Oiling Systems, Turbine.**
Richardson-Phenix Co.

**Packing.**
Johns-Manville Co., H. W.

**Panel Boards.**
Crouse-Hinds Co.
General Electric Co.
Westinghouse Elec. & Mfg. Co.

**Panels, Switchboard.**
General Electric Co.
Packard Elec. Co.

**Photometric Apparatus.**
Elec'l Testing Laboratories.
Leeds & Northrup Co.

**Pinions, Rawhide**
New Process Gear Corp.

**Pipe Fittings.**
Richardson-Phenix Co.

**Pipe, Wood**
Continental Pipe Mfg. Co.

**Platinum.**
Baker & Co., Inc.

**Plugs.**
Condit Electrical Mfg. Co.
Crouse-Hinds Co.
Cutler-Hammer Mfg. Co.
General Electric Co.
Hubbell, Inc., Harvey.
National Metal Molding Co.

**Pole Erectors.**
American Bridge Co.
Matthews & Bro., Inc., W. N.

**Pole Line Hardware.**
Hubbard & Co.
Western Elec. Co.

**Poles and Ties, Wood**
McGillis & Gibbs

**Poles, Brackets and Pins.**
Western Elec. Co.

**Poles, Reinforcing.**
Hubbard & Co.

**Poles, Steel.**
American Bridge Co.
Archbold-Brady Co.
Bates Exp. Steel Truss Co
Blaw-Knox Co.
Milliken Bros.

**Porcelain. (See Insulating Material, China and Porcelain.)**

**Potentiometers.**
Biddle, James G.
General Electric Co.
Leeds & Northrup Co.

**Potheads.**
G. & W. Electric Specialty Co.
Okonite Co., The.

**Presses, Cutting**
Bliss Co., E. W.
Ferracute Machine Co.

**Projectors, Floodlighting**
Crouse-Hinds Co.
Electric Service Supplies Co.

**Protective Devices.**
Condit Electrical Mfg. Co.
Crouse-Hinds Co.
General Electric Co.
Metropolitan Engineering Co.
Schweitzer & Conrad, Inc.
Square D. Co.

**Pulleys**
Amer. Pulley Co.

**Pumps, Air.**
Worthington P. & M. Corp.

**Pumps, Centrifugal.**
Allis-Chalmers Mfg. Co.
Manistee Iron Wks. Co.
Terry Steam Turbine Co.
Worthington Pump & Mach'y Corp.

**Pumps, Deep Well**
Worthington Pump & Mach'y Corp.

**Pumps, House Service**
Worthington Pump & Mach'y Corp.

**Pumps, Hydraulic**
Worthington Pump & Mach'y Corp.

**Pumps, Motor Driven.**
Worthington P. & M. Corp.

**Pumps, Oil.**
Richardson-Phenix Co.
Worthington P. & M. Corp.

**Pumps, Power**
Worthington Pump & Mach'y Corp.

**Pumps, Steam Driven.**
Allis-Chalmers Mfg. Co.
Terry Steam Turbine Co.
Worthington, P. & M. Corp.

**Pumps, Turbine Driven**
Terry Steam Turbine Co.

**Pumps, Vacuum.**
Worthington P. & M. Corp.

**Pumps, Water Works.**
Terry Steam Turbine Co.

**Pyrometers.**
Bristol Co., The.
Leeds & Northrup Co.

**Rail Bonds.**
American Steel & Wire Co.
Condit Electrical Mfg. Co.

**Ranges, Elec.**
General Electric Co.

**Receptacles. (See Sockets and Receptacles.)**

**Receptacles, Sign**
Federal Sign System

**Rectifiers.**
General Electric Co.

**Regulators, Pressure**
Engineer Co., The

**Regulators, Series Lighting.**
Packard Elec. Co.

**Repairing.**
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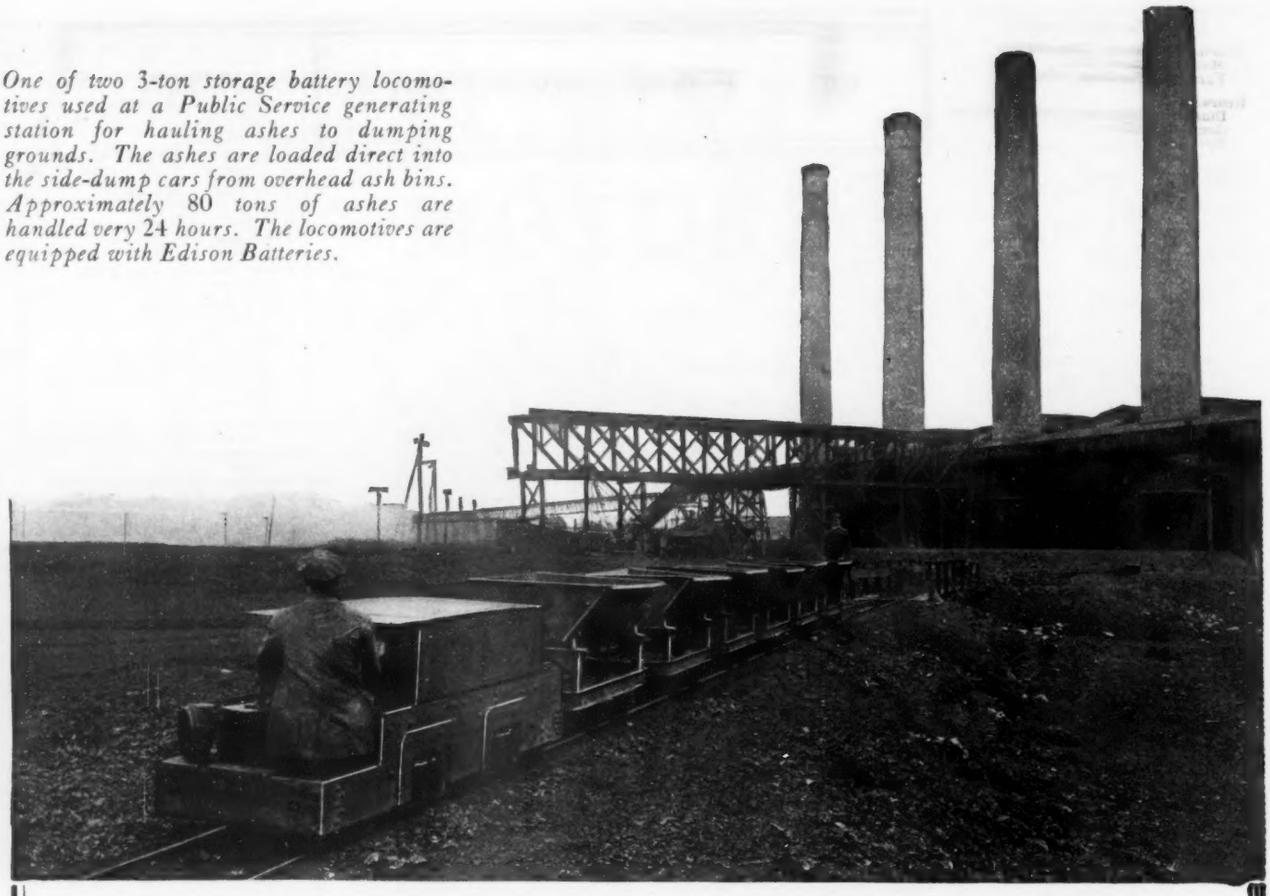
Gregory Electric Co.
Independent Elec. Machinery Co.
Nelson, I. R.
Randle Machry. Co.
Standard Elec & Elev. Co.
Venino Bros. & Co.

**Resistance Units.**
Cutler-Hammer Mfg. Co.
Electric Controller & Mfg. Co.
General Electric Co.
Industrial Controller Co.
Ward Leonard Elec. Co.

*One of two 3-ton storage battery locomotives used at a Public Service generating station for hauling ashes to dumping grounds. The ashes are loaded direct into the side-dump cars from overhead ash bins. Approximately 80 tons of ashes are handled very 24 hours. The locomotives are equipped with Edison Batteries.*



# Storage Battery Locomotives

## for handling ashes, lumber, cinders, waste materials, etc., in Power and Industrial Plants, Lumber Yards, etc.

The storage battery locomotive is especially adapted to the heavy haulage needs of power plants, foundries, mills, lumber yards, etc. They release many men for more productive work and eliminate the inefficient horse or mule.

Fire risk is reduced, for these locomotives can go in many places where smoke, fumes, hot cinders or exhaust gases forbid other means. Their power is off-peak current—a central station load that meets war-time conditions.

This service is hard and rough for batteries—it takes the steel-and-iron construction of the Edison cell to stand up, year after year. Edison cells are standard for this work, they give highest service efficiency.

***Bulletin 608-W, "Edison Storage Batteries for Storage Battery Locomotives" on request.***

## EDISON STORAGE BATTERY COMPANY

**Factory and Main Office: ORANGE, N. J.**

**Distributors in**

**New York Boston Chicago Detroit San Francisco**
**Seattle Los Angeles New Orleans Pittsburgh**
**Kansas City Washington Philadelphia**

EDISON STORAGE BATTERIES

TRADE MARK Thomas A. Edison A PRODUCT OF THE EDISON LABORATORIES

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**Resistance, Wire.**
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Biddle, James G.
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Cutler-Hammer Mfg. Co.
Electric Controller & Mfg. Co.
General Electric Co.
Industrial Controller Co.
Monitor Controller Co.
Sundh Electric Co.
Ward Leonard Elec. Co.
Westinghouse Elec. & Mfg. Co.

**Rosettes.**
National Metal Molding Co.

**Screw Machine Products**
International Arms & Fuze Co.

**Searchlights.**
Crouse-Hinds Co.
General Electric Co.

**Second-hand Apparatus.**
See Searchlight Section.
Adams, Geo. Francis.
Archer & Baldwin.
Baldwin & Copeland
Bissell Co.
Brew, Wm. P.
Brown-Hunkele Corpn.
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Consolidated Machy. & Wrecking Co.
Cravath, James R.
Davis Machine & Motor Co.
Dotterweich Co., A. J.
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Elliott Elec. Co.
General Equipment Co.
Gregory Electric Co.
Harris Bros. Co.
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Klein & Co., Nathan.
MacGovern & Co.,
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O'Brien Machy. Co., The
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Power Equipment Co.
Power Machy. Exchange.
Randle Machinery Co.
Reliable Electric Motor Co.
Ross Power Equipment Co.
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Schwartz & Land.
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Toomey, Inc., Frank.
Venino Bros. & Co.
Vindex Elec. & Mfg. Co.
Wilson Machy. Co., H. R.
Zelnicker, Walter A.

**Separators, Magnetic.**
Cutler-Hammer Mfg. Co.

**Shades, Tin**
Ostrander & Co., W. R.

**Shade Holders.**
Hubbell, Inc., Harvey.

**Sheet Metal.**
Am. Sheet & Tin Plate Co.
Bliss Co., E. W.

**Sheets, Electrical.**
Am. Sheet & Tin Plate Co.

**Signs**
Federal Sign System

**Sign Letters**
Federal Sign System

**Sockets and Receptacles.**
Crouse-Hinds Co.
Cutler-Hammer Mfg. Co.
Federal Sign System
General Electric Co.
Hubbell, Inc., Harvey
National Metal Molding Co.
Ostrander & Co., W. R.

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Allen Co., Inc., L. B.
Blake Signal & Mfg. Co.

**Soldering Irons**
Cutler-Hammer Mfg. Co.

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Electric Controller & Mfg. Co.
General Electric Co.
Industrial Controller Co.
Ward Leonard Elec. Co.

**Special Machinery.**
Bliss Co., E. W.

**Splicing Compounds**
United States Rubber Co.

**Springs.**
American Steel & Wire Co.
Cary Spring Works.

**Sprockets, Silent Chain.**
Morse Chain Co.

**Stacks, Steel, Smoke.**
American Bridge Co.

**Stage Lighting Apparatus.**
Campbell Electric Co.
Condit Electrical Mfg. Co.

**Staples.**
American Steel & Wire Co.
Blake Signal & Mfg. Co.

**Starters, Motor.**
Condit Electrical Mfg. Co.
Cutler-Hammer Mfg. Co.
Electric Controller & Mfg. Co.
General Electric Co.
Sundh Elec. Co.
Union Elec. Mfg. Co.
Ward Leonard Elec. Co.

**Stokers.**
American Engineering Co.
Combustion Engineering Co.
Green Eng'g Co.
Riley Stoker Co., Sanford, Ltd.

**Stoves, Elec. (See Ranges, Elec.)**

**Structural Steel.**
Milliken Bros. Mfg. Co.

**Sub-Stations, Outdoor.**
Delta Star Elec. Co.
General Elec. Co.
Transmission Eng'g Co.

**Supplies (Electric Railway).**
General Electric Co.
Johns-Manville Co., H. W.
Western Elec. Co.

**Supplies, Electrical.**
General Electric Co.
Manhattan Elecl. Supply Co.
Western Elec. Co.

**Switchboard Mats**
United States Rubber Co.

**Switchboard Supplies.**
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General Electric Co.
Lewis & Roth Corp.
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Westinghouse Elec. & Mfg. Co.

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Crouse-Hinds Co.
Electrical Engineering Co.
General Electric Co.
Roller-Smith Co.
Triumph Electric Co.
Trumbull Elec. Mfg. Co.
Wagner Elec. Mfg. Co.
Western Elec. Co.
Westinghouse Elec. & Mfg. Co.

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Anderson Mfg. Co., A. & J. M.
General Elec. Co.
Matthews & Bro., Inc., W. N.

**Switches, Disconnecting.**
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General Elec. Co.
Lewis & Roth Corp.
Matthews & Bro., Inc., W. N.
Schweitzer & Conrad, Inc.
Trumbull Electric Mfg. Co.

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Palmer Elec. & Mfg. Co.
Square D. Co.
Trumbull Elec. Mfg. Co.

**Switches, Float.**
Cutler-Hammer Mfg. Co.
General Elec. Co.
Sundh Elec. Co.

**Switches, Fuse.**
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Matthews & Bro., Inc., W. N.
Metropolitan Eng'g Co.

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Crouse-Hinds Co.
Electric Controller & Mfg. Cc.
General Electric Co.
Palmer Elec. & Mfg. Co.
Square D. Co.
Trumbull Elec. Mfg. Co.
Westinghouse Elec. & Mfg. Co.

**Switches, Oil.**
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General Electric Co.
Westinghouse Elec. & Mfg. Co.

**Switches, Pole Top.**
Condit Electrical Mfg. Co.
Delta-Star Elec. Co.
Electrical Engineers Equipment Co.
General Electric Co.
Lewis & Roth Corp.
Railway & Industrial Eng. Co.

**Switches, Remote Control.**
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Cutler-Hammer Mfg. Co.
General Electric Co.
Palmer Elec. & Mfg. Co.
Sundh. Elec. Co.

**Switches, Safety.**
General Elec. Co.
Palmer Elec. & Mfg. Co.
Square D. Co.
Trumbull Elec. Mfg. Co.

**Switches, Series.**
G. & W. Electric Specialty Co.
General Elec. Co.

**Switches, Snap and Push Button**
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General Electric Co.

**Switches, Time.**
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General Elec. Co.
Hartford Time Switch Co.
Matthews & Bro., Inc., W. N.
Paragon Electric Co.

**Tachometers.**
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Bristol Co., The.
Foxboro Co., The.
Johns-Manville Co., H. W.
Roller-Smith Co.

**Taps and Dies**
Carpenter Tap & Die Co., J. M.

**Telephone Service.**
American Tel. & Tel. Co.

**Telephones**
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Leeds & Northrup Co.
Roller-Smith Co.
States Company, The

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Elecl. Testing Laboratories.
Illinois Testing Laboratories

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Industrial Controller Co.
Ward Leonard Elec. Co.

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Foxboro Co., The.
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Bates Exp. Steel Truss Co.
Blaw-Knox Co.
Milliken Bros Mfg. Co.
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Transmission Eng'g Co.

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Enterprise Electric Co.
General Electric Co.
Kuhlman Elec. Co.
Metropolitan Eng'g Co.
Moloney Electric Co.
Packard Elec. Co.
Pittsburgh Transformer Co.
Thordarson Electric Co.
Triumph Electric Co.
Wagner Elec. Mfg. Co.
Westinghouse Elec. & Mfg. Co.

**Transformers, Bell Ringing.**
Packard Elec. Co.
Pittsburgh Transformer Co.
Westinghouse Elec. & Mfg. Co.

**Transmission, Silent Chain**
Morse Chain Co.

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General Electric Co.
Ridgway Dynamo & Eng. Co.
Terry Steam Turbine Co.

**Turbo-generators.**
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Federal Sign System
Hoover Suction Sweeper Co.
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Richardson-Phenix Co.

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Western Elec. Co.

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Permutit Company.

**Water Softening Apparatus.**
Permutit Company.
Scaife & Sons Co., Wm. B.

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Smith Co., S. Morgan.
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Lombard Governor Co.
Woodward Governor Co.

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New England Butt Co.

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Page Steel & Wire Co.

**Wire, Rubber Covered.**
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Roebling's Sons Co., John A.

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Driver-Harris Wire Co.
Electrical Alloy Co.

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Amer. Brass Co.
Amer. Electrical Works.
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Benedict & Burnham Mfg. Co.
D & W Fuse Co.
Driver-Harris Wire Co.
Electric Cable Co.
General Electric Co.
Hazard Mfg. Co.
Independent Lamp & Wire Co.
Indiana Rub. & Ins. Wire Co.
Kerite Ins. Wire & Cable Co.
Lowell Ins. Wire Co.
Massachusetts Elec. Mfg. Co.
New York Insulated Wire Co.
Okonite Co., The.
Packard Elec. Co
Page Steel & Wire Co.
Phillips Wire Co.
Roebling's Sons Co., J. A.
Rome Wire Co.
Safety Ins. Wire & Cable Co.
Simplex Wire & Cable Co
Western Elec. Co.

**Wire and Cables Auto.**
Packard Elec. Co.

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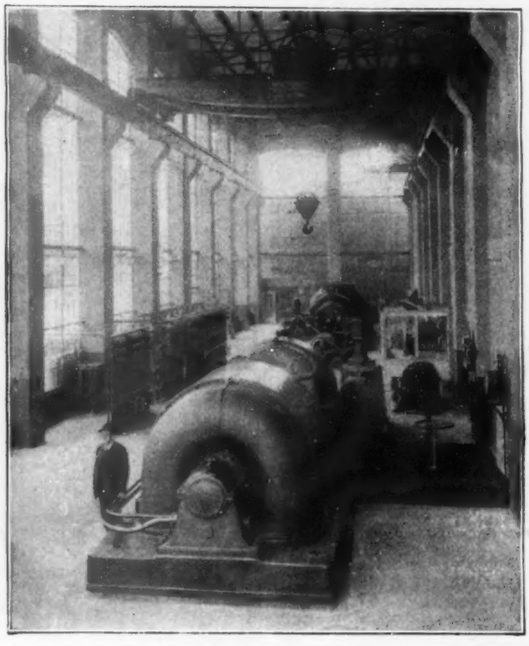
Continental Pipe Mfg. Co.

**X-Ray Apparatus.**
Campbell Electric Co.
General Elec. Co.

# STEAM TURBINES

## BUILT FOR CONTINUOUS OPERATION



**Municipal Power Plant, City of Seattle**

**One 7500 kw. Allis-Chalmers Steam Turbine, Installed Sept. 1914.**
**One 10,000 kw. Allis-Chalmers Steam Turbine, Installed May, 1918**

**Allis-Chalmers Turbines Sell on Their Operating Record**

**Allis-Chalmers Manufacturing Co.**
**Milwaukee, Wis.**

***Sales Offices in All Principal Cities of the World***

**Our Name Is Your Assurance**

# ALLIS-CHALMERS

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# LINCOLN MOTORS

## What a Lincoln Motor Stood

### It isn't easy to damage a Lincoln Motor —but our test engineers tried it once. Here's what they did to it.

They overloaded it almost to a standstill for ten hours intermittently without effect.

They jammed the pulley, opened one phase and switched on full voltage, for 45 minutes across two terminals. Still no grounds or short circuits.

Finally with the rotor still fixed, they switched on all three phases till the motor caught fire.

And even then they only had to throw a few buckets of water on it, to put out the flames and it ran as well as ever.

You appreciate ruggedness and overload capacity which this test implies. Perhaps, however, some of your customers do not. But they would like to know. *Tell them.*

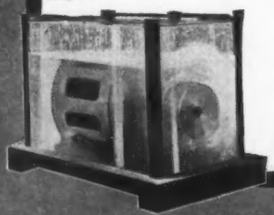
*Write for bulletin on Motors* 101-E.

Lincoln Elevator Motor, 5 H.P., back geared, elevating flint and spar in the plant of The Standard Sanitary Mfg. Co., Tiffin, Ohio.

This motor is on top of the building, and operated for eighteen months without any cover over it, where it was continually exposed to snow and sleet.

*"Link Up With Lincoln"*

This Lincoln Motor operated under water over 3 years without damage to windings.



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The record of R & M equipped devices in use is invariably a record of efficient reliable service.

And this fact is generally known to men and women everywhere. For a decade the R & M Motor has been advertised consistently to the general public through the leading popular magazines. R & M Motor Quality is known to nearly all men and women who are prospective purchasers of motors or motor-equipped devices.

The R & M Motor on any device, whether vacuum cleaner, washing machine, fan or other machine for home, office, store or factory, is a known product which speaks for the quality and reliability of the machine.

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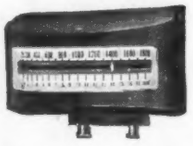

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3

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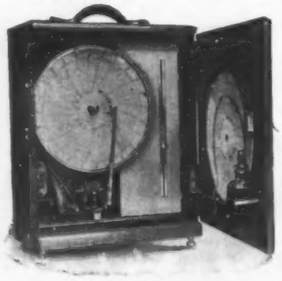

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